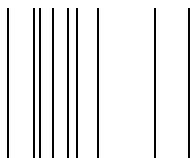
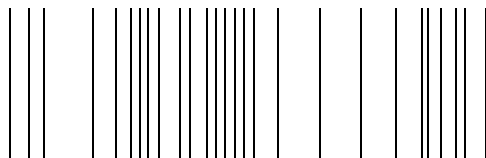
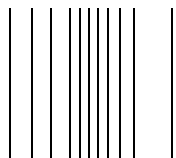


be in motion **be in motion**



b maXX[®] BM1000

Basic unit

Manual

E

5.07003.04



| | |
|----------|-----------------------|
| Title | Manual |
| Product | b maXX® BM1000 |
| Version | 5.07003.04 |
| Part No. | 410406 |
| Status | 29.02.2008 |

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| Manufacturer | <p>Baumüller Nürnberg GmbH Ostendstr. 80 - 90 D-90482 Nürnberg Germany Tel. +49 9 11 54 32 - 0 Fax: +49 9 11 54 32 - 1 30 www.baumueller.de</p> |
|--------------|--|



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INTRODUCTION

This manual is an important part of your **b maXX® BM1000** appliance. Therefore please read this manual completely, before starting any operation, last but not least on behalf of your own security.

In this chapter we describe the first steps, which have to be done after you have received the device. Terms are defined, which are continuously used in this manual. We will inform you about duties, which must be considered when using this device.

1.1 Survey of the appliance series **b maXX® BM1000**

This manual is to be used for the installation, parameter setting, troubleshooting, and daily maintenance of the Baumüller device '**b maXX® BM1000**'. To guarantee safe operation of the equipment, read the safety guidelines before connecting power to the **b maXX® BM1000**. Keep this operating manual at hand and distribute to all users for reference.



WARNING

The following **may occur**, if you disregard these safety notes:

m serious personal injury m death

All persons, who work on and with devices of the series **b maXX®**, must have this manual available at their work place and must obey the instructions and notes contained therein - especially the safety instructions.

1.2 First steps

- h Check delivery, see [ZTransportation and packing](#)— from page 23.
- h Provide for qualified personnel for the mounting, installation and commissioning.
- h Hand over this manual to the personnel for mounting, installation and commissioning. Assure that especially the safety instructions are understood and obeyed.

1.3 Used terms

In this manual we will also use the term 'device' for the Baumüller product '**b maXX**[®]'. A list of the abbreviations which are used are to be found in [ZAppendix A - Abbreviations](#)— from page 117.

1.4 Copyright and trade mark

b maXX[®] is a registered trade mark of Baumüller Nürnberg GmbH

FUNDAMENTAL SAFETY INSTRUCTIONS

2.1 General notes

In this chapter dangers are described, arising when working with the Baumüller-device. Dangers are pointed up with symbols (icons). All symbols that are used in this manual are listed and explained.

How you can protect yourself against the single dangers in the concrete case, we will not explain in this chapter. This chapter contains only general protective measures. The concrete protective measures we will always give directly after the note to the danger.

The operation of the described devices is permissible, if the mentioned methods/procedures/measures are obeyed to. Everything else, that means also the operation of devices in installations, which are not shown here, is not permitted and must be checked with the company in each particular case. Any kind of claim to warranty will expire, if the devices are operated other than here described.



WARNING

The following **may occur**, if you do not observe this warning information:

m serious personal injury m death

The hazard information is showing you the hazards which can lead to injury or even to death.

Always observe the hazard information given in this documentation.

2.2 Hazard information and commands

Each hazard is classified in one of three different hazard classes. Every hazard class has one of the following characteristic signal words:

DANGER

m serious property damage m serious personal injury m death - **will** occur

WARNING

m serious property damage m serious personal injury m death - **may** occur

CAUTION

m minor to medium personal injury or
m environmental pollution or
m property damage - **may** occur

2.2.1 Hazard information structure

The following two examples show you how the hazard informations are constructed. The triangle is used when indicating a hazard for human beings. When there is a circle instead of the triangle, the hazard information is only for possible property damage.



A triangle indicates hazard for human beings.
The shade of grey of the outline reflects the severity of the hazard - darker grey means rising hazard.



The icon within the square illustrates the hazard.
The outline's shade of grey reflects the severity of the hazard - darker grey means rising hazard. (Not every hazard information has a square representing the hazard, so we have shown it as draft here)



The icon in the circle represents a command.
(Not every hazard information has a circle representing the hazard, so we have shown it as draft here)



The circle indicates hazard for property.



The icon within the square illustrates the hazard.
The outline's shade of grey reflects the severity of the hazard - darker grey means rising hazard. (Not every hazard information has a square representing the hazard, so we have shown it as draft here)

The text beneath the icons is constructed as follows:

HERE STANDS THE SIGNAL WORD WHICH INDICATES THE DEGREE OF THE HAZARD

Here we tell if one or more of the consequences described lower will occur if this hazard information is not observed.

here we describe the possible consequences. The worst consequence stands on the right side.

Here we describe the hazard.

Here we describe what you can do to avoid this hazard.

2.2.2 Form of the hazard sign (triangular or round)


If there is a triangle like or or in front of the signal word, the hazard information is referring to personal damage.

If there is a round hazard signal like in front of the signal word, the hazard information is referring to property damage.

2.2 Hazard information and commands

2.2.2.1 Hazard information on personal injury

To distinguish each class of hazard information, we use a characteristic outline for both the triangular hazard signs and the square-form icons

For the hazard class **DANGER** the  danger sign is used. The hazard information of this hazard class used in this documentation is listed below:



DANGER


The following **will occur**, if you do not observe this danger information:

m serious personal injury m death



*The hazard is: **electricity**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

For the hazard class **WARNING** the warning sign  is used. The following hazard information of this hazard class is used in this documentation.



WARNING

The following **may occur**, if you do not observe this warning information:

m serious personal injury m death



*The hazard is: **electricity**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



WARNING


The following **may occur**, if you do not observe this warning information:

m serious personal injury m death



*The hazard is: **electro-magnetic radiation**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

For the hazard class **CAUTION** the caution sign  is used when there is hazard for persons or of environmental pollution. The following hazard information of this hazard class is used in this documentation.

CAUTION



The following **may occur**, if you do not observe this caution information:

m minor to medium personal injury.



*The hazard is: **hot surface**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

CAUTION



The following **may occur**, if you do not observe this caution information:

m minor to medium personal injury.



*The hazard is: **sharp edges**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

CAUTION



The following **may occur**, if you do not observe this caution information:

m minor to medium personal injury.



*The hazard is: **injury of the eye caused by ricocheting particles**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

CAUTION



The following **may occur**, if you do not observe this danger information:

m environmental pollution.



*The hazard is: **inadequate disposal**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

2.3 Information sign

2.2.2.2 Hazard information on property damage

If there is a round caution sign ⓘ in front of the signal word, the safety information refers to property damage.



CAUTION

The following **may occur**, if you do not observe this caution information:
m property damage.

*The hazard is: **electro-static discharge**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



2.2.2.3 Command signs used



wear safety gloves



wear safety shoes



wear eye protection



wear ear protection



Use this fire extinguishing agent:
„fire extinguishing agent“

2.3 Information sign



NOTE

This note is a very important information.

2.4 Legal instructions

This documentation is addressed to technical qualified personnel, who is specifically skilled and who is thoroughly familiar with all warnings and maintenance procedures.

The devices are made according to the state-of-the-art technology and are fail-safe. They can be installed safe, can be put into operation and they function without problems, if it is assured, that the instructions of the documentation are followed.

The user is responsible for the execution of service and commissioning according to the safety instructions of the prevailing standards and other relevant national and local instructions concerning conductor dimensioning and protection, earthing, disconnecter, overcurrent protection and so on.

For damages, which result from the mounting or from the connection, the one is liable, who has carried out the mounting or the installation.

2.5 Appropriate use

Always use the device according to the terms. Stated below we have carried a few important notes together. The notes stated below shall give you a feeling for the according to the terms usage of the device. We do not raise any claim for the completion of the notes stated below - follow all instructions given in this operating instruction.

- m project the application in such a way, that you always operate the device within its specification.
- m use this device only as converter for drives.
- m make sure, that only qualified personnel work with/at this device.
- m install this device only on an adequate carrying wall.
- m install this device in the way as it is described in the documentation.
- m make sure, that the mains/power supply unit always applies to the predetermined specifications.
- m only operate the device, if it is technical faultlessly.
- m operate this device only in combination with released components of the company Baumüller Nürnberg GmbH.
- m always operate the device in an area as it is instructed in the „Technical data“.
- m always operate the device in serialized condition.
Due to safety reasons you must not rebuild the device.
- m consider all instructions referring to this, if you intend to store the device.

You are using the device according to the terms, as soon as you regard all notes and information in this operating manual.

2.6 Inappropriate use

Listed below you will find some examples of non-appropriate application. The information below is intended to give you some impression of what non-appropriate application is. However we cannot state all possible non-appropriate applications here. All applications, where the notes and information given in this documentation is disregarded, are non-appropriate and therefore forbidden.

Examples:

- m You disregarded the notes in this manual.
- m The device has not been specifically applied as a converter in order to control a motor.
- n The device has been
 - m mounted incorrectly,
 - m connected incorrectly,
 - m commissioned incorrectly,
 - m operated incorrectly,
 - m mounted, connected, commissioned, operated and/or maintained by not qualified or inadequately qualified personnel,
 - m inappropriately maintained or not maintained (also consider the descriptions of the components),
 - m overloaded it,
- n operated
 - m with defective safety devices,
 - m with incorrectly mounted safety devices or without safety devices,
 - m with incorrectly working safety- and protection devices,
 - m outside the specified environmental conditions.
- m You have modified the device.
- m You have insufficiently monitored the parts, which are subject to a wearing.
- m You have improperly carried out a repair.
- m You have combined the device with improper products, which are not enabled for devices described in this manual.
- m You have combined the device with faulty and/or faulty documented products of other manufacturers.
- m The device has been operated in an explosive environment.

2.7 Safety equipment

The devices **b maXX® BM1000** comply with the protection class IP 20.

WARNING

The following **may occur**, if you do not observe this warning information:

- m serious personal injury
- m death

*The danger is: **electricity**.*

Operate the device in a control cabinet, which provides a protection against a direct touching of the devices and fulfills at least the demands of the EN61800-5-1, chapter 4.2.3.3.



2.8 Training of the personnel



WARNING

The following **may occur**, if you do not observe this warning information:

m serious personal injury m death

Devices of the company Baumüller Nürnberg GmbH may only be assembled, installed, operated and maintained by qualified personnel.

Qualified personnel (professionals) is defined below:

Qualified personnel

Authorized electronic engineers and skilled persons of the customer or third persons, who have learned the installation and commissioning of Baumüller drive systems and who are authorized, to put circuits and devices into operation according to the standards of the safety technology, to ground and to label.

Qualified personnel has a training or an instruction due to the local valid standards of the safety technique in maintenance and usage of an adequate safety equipment.

Requirements to the operating personnel

The operating of the drive system must only be executed by persons, who have had a training, who have been instructed and who have been authorized for this.

Fault clearance, servicing, cleaning, maintenance and exchange must only be carried out by skilled or instructed personnel. These persons must know the operating manual and must act according to this.

The commissioning as well as the instruction must only be carried out by qualified personnel.

2.9 Safety precautions in normal operation

h at the location of your appliance regard the safety regulations for the plant, into which the appliance has been built in.

h if safety regulations require additional monitoring or safety devices supply your appliance with them.

2.10 Dangers due to residual energy

Electrical residual energy

After separation of the device from the mains parts under voltage as e. g. power connections may be only then touched if the capacitors in the device are discharged. To prevent personal injury, please ensure that power has been turned off before opening the **b maXX® BM1000** and wait ten minutes for the capacitors to discharge to safe voltage levels.

Mechanical residual energy

The mechanical residual energy is dependent upon the application. As we don't know the application, we cannot make any exact statements. Driven parts also rotate/move after disconnection of the mains supply for a certain time. Please, provide adequate safety arrangements.

2.11 Disposal of the device

2.11 Disposal of the device

The accurate disposal of the device is described in [Z12 Disposal](#)– on page 113.

2.12 Fire fighting



WARNING

The following **may occur**, if you do not observe this warning information:

m serious personal injury m death



The danger is: **Electricity when using a conductive fire fighting appliance.**



Use this fire extinguishing agent:

ABC powder / CO₂

2.13 Responsibility and liability

To be able to work as safe as possible with this device, you must know and follow the danger notes as well as the safety instructions.

2.13.1 Observing the safety notes and safety instructions

In this manual we use visually unified safety instructions, which are intended to prevent from personal injury or damage to property.



WARNING

The following **may occur**, if you do not observe this warning information:

m serious personal injury m death

All persons, who work with this device, must know and regard the safety notes and the safety instructions in this manual.

Apart from this, any and all persons who work on this device must additionally know and regard to all regulations and instructions, that are valid at the location.

2.13.2 Dangers when handling this device

The device „b maXX®“ was developed and manufactured according to the state-of-the-art technology and in compliance with the valid regulations and standards. It is still possible that dangers can arise during use. An overview of possible dangers is to be found in chapter [ZFundamental safety instructions](#)– from page 11.

We warn you against the acute danger at the respective places in this manual.

2.13.3 Warranty and Liability

All information in this manual is non-binding customer information; it is subject to ongoing further development and is updated on a continuous basis by our revision service.

Warranty- and liability claims against Baumüller Nürnberg GmbH are excluded if in particular one or more of the causes listed in [ZInappropriate use](#)— from page 18 has/have caused the damage.

TRANSPORTATION AND PACKING

In this chapter we describe, which conditions have to be adhered to at transportation, how you check the device after receipt and what you should have to consider, if you dispose the packing.

3.1 To be considered by transportation

For the first transportation of the device, the device was packed in the manufacturer company. In case you transport the device, assure, that the following conditions are fulfilled during the whole transportation:

- m -20°C to +60°C (temperature range)
- m max. 1 g (vibration, shock, repetitive shock)

3.2 Unpacking

After receipt of the device, which is still packed:

- h Avoid strong transportation vibrations and severe hits, e.g. when setting down.
- h Check, if transportation damages are visible!

If so:

- h Immediately complain to the deliverer. Let the claim be confirmed in writing and immediately contact the substitution of Baumüller Nürnberg GmbH, which is in charge for your company.

WARNING

The following **may occur**, if you disregard these safety notes:

- m serious personal injury m death

*The danger is: **electricity**.*

Do not operate the device, if you have recognized a transportation damage or if you assume this. In this case immediately contact Baumüller Nürnberg GmbH



3.3 Dispose packing

If there is no transportation damage recognizable:

- h Open the packing of the device.
- h Check the scope of supply with the help of the delivery note.

The minimum scope of supply is:

m **b maXX® BM1000**

- m This manual inclusively the copy of the declaration of conformity/declaration of manufacturer
- h Claim at the Baumüller substitution, which is in charge, in case the delivery is not complete.

3.3 Dispose packing

The packing is made of cardboard, plastics, metal parts, corrugated cardboard and/or wood.

- h Regard the local disposal instructions, in case you dispose the packing.

DESCRIPTION OF THE DEVICES

In this chapter the basic construction of the device **b maXX[®] BM1000** is described and the type key on the devices is explained.



NOTE

The devices of the **b maXX[®] BM1000**-series are provided for the operation in the 'second environment' (industrial environment) according to EN 61800-3. At connection to the public mains EMC problems can appear. Also see [ZAppropriate use](#)— from page 17.

4.1 Structure

The devices of the **b maXX[®]**-series are converters of Baumüller Nürnberg GmbH. The devices consist of a power unit with an integrated controller.

The rated current of the devices reach for 1-phase devices from 1.6 A to 11 A and for 3-phase devices from 1.5 A to 24 A. The devices differ in size, power and cooling.



NOTE

The **b maXX[®] BM1000** is to be used to control 3-phase asynchronous standard motors in the power range of 0.2 to 11 kW (rated power of the drive).

4.2 Interconnect the devices

This data is available in the type key (see [ZMarking of the device - type key](#)— on page 27).



Figure 1: b maXX® BM1000

4.2 Interconnect the devices

The device is part of the Baumüller series **b maXX® BM1000** and can be connected together with other Baumüller devices.

4.3 Overview of dangerous areas

The following overview shows the existing danger areas on the particular device. Use this survey for an overview of the existing danger areas, if you incorporate into the handling of this device. The explanation of the symbols, which are used you will find in [ZHazard information and commands](#)— from page 12.



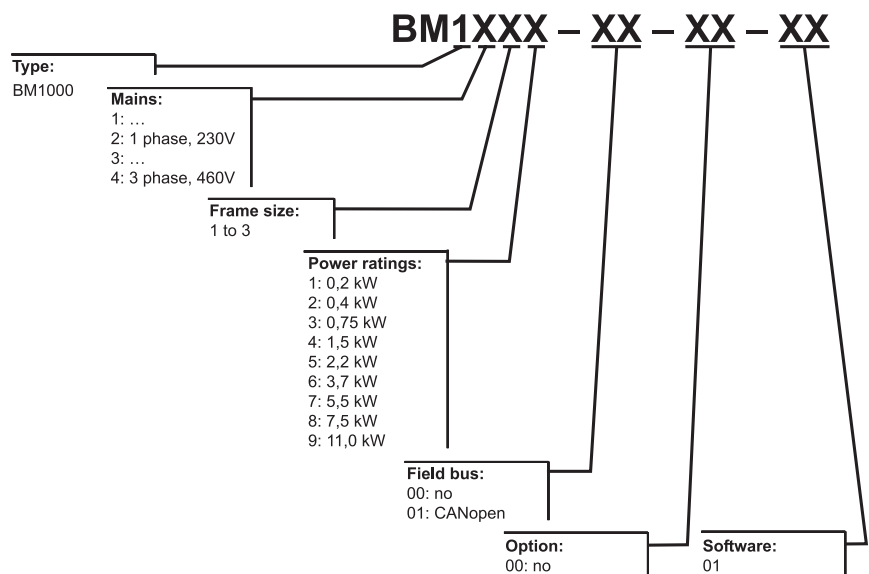
Figure 2: Danger areas b maXX® BM1000

4.4 Marking of the device - type key

On the type plate (label) you will find, besides others, the type key of the device.



m Type key



NOTE

If the type key information does not correspond to your purchase order or if there are any problems, please contact your distributor.

4.4 Marking of the device - type key

- m Drive frames
 - n Frame 1 (0,2 -1,5 kW)

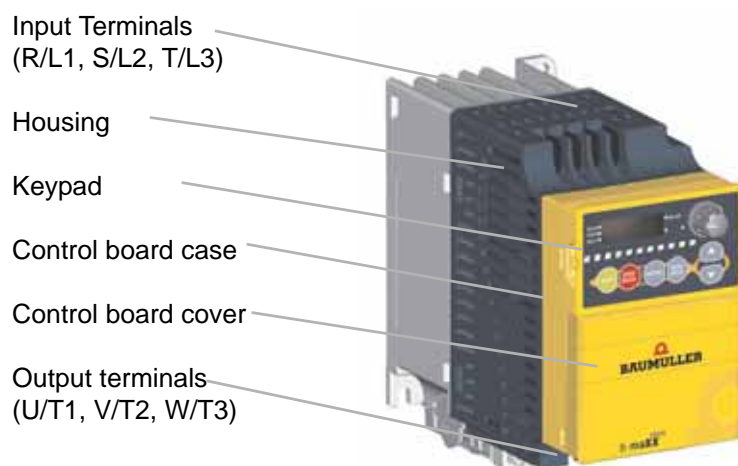


Figure 5: b maXX® BM1000 Frame 1

- n Frame 2 (0,75 - 3,7 kW)



Figure 6: b maXX® BM1000 Frame 2

n Frame 3 (5,5 - 11,0 kW)

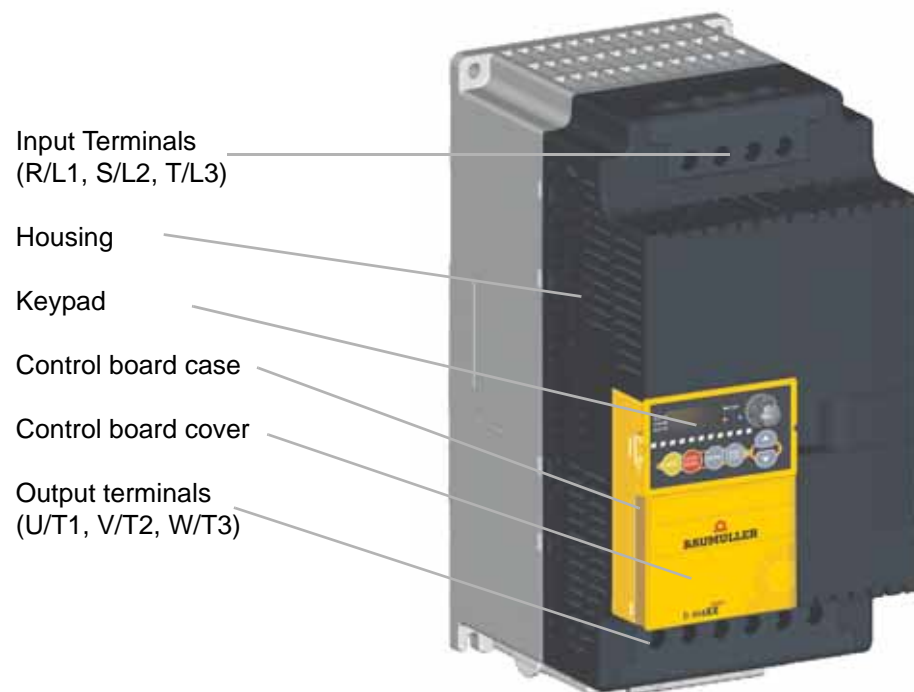


Figure 7: b maXX[®] BM1000 Frame 3

4.5 Preparation for installation and wiring

4.5.1 Remove keypad



Figure 8: Remove keypad

4.5 Preparation for installation and wiring

4.5.2 Remove front cover

Step 1



Step 2



Figure 9: Remove front cover

4.5.3 Remove main terminal cover

Frame 2 and frame 3



Figure 10: Remove mains terminal cover

4.5.4 Remove motor terminal cover

Frame 2 and frame 3



Figure 11: Remove motor terminal cover

4.5.5 Remove fan



Figure 12: Remove fan

MOUNTING

In this chapter we describe the mechanical mounting of the device into a control cabinet. Data about the installation space is available in this manual (see [ZInstallation space—](#) from page 36).

Mounting consists of the following steps:

- 1 Prepare mounting (drill holes/cut-out segments)
- 2 Install device



WARNING

The following **may occur**, if you do not observe this warning information:

m serious personal injury m death

At execution of any mounting workings it must be assured that no strange substances (e.g. drilling chips, copper wire etc.) get into the device. If possible the drillings should be done before mounting the device and the assembling of the cables should be done outside the control cabinet. If this is not possible, the device must be covered accordingly.

5.1 General safety instructions



CAUTION

The following **may occur**, if you disregard these safety notes:

m Property damage



*The danger is: **electrostatic discharge**. Connections of the device sometimes are dangerous to ESD.*

Regard the corresponding notes.

h Please regard to the information in chapter [ZFundamental safety instructions—](#) from page 11.

5.2 Requirements to the executing personnel

- h Pay attention to all areas at the device, which could be dangerous for you while mounting. Use this survey only for the mechanical mounting. Dangers, which, for example, result from electricity are not shown here.



Figure 13: Danger areas by the mechanical mounting

5.2 Requirements to the executing personnel



CAUTION

The following **can occur**, if you disregard this warning instruction:

- m minor to medium personal injury.

*The danger is: **sharp edges**. In case, while installing, you lift a device with unprotected hands, fingers/palm can be cut. If the device falls off, your feet can be cut up.*

Make sure, that only qualified personnel, who is familiar with the safety- as well as with mounting instructions, works on this unit.



Wear safety gloves



Wear safety shoes

Qualified personnel are persons, who have been instructed by the responsible person, based on their training, experience, the instructions they were given as well as their knowledge about relevant standards and instructions, knowledge of the accident prevention instructions and of the company, to execute the necessary operations and thereby are able to recognize and avoid the dangers which could happen. The required qualifications for the work with this unit are for example:

- m Training or instruction due to the standards of the safety engineering in maintenance and use of appropriate safety equipment.

5.3 Prepare mounting

You can prepare the mounting with the configuring manual for your installation. With the project manual and the drill figures (see [ZDimensions](#)— from page 39) you can determine the dimensions for the cut-outs and for the fastening drills.

CAUTION

The following **can occur**, if you disregard this warning instruction:

m minor to medium personal injury.

*The danger is: **Eye injury due to catapulting particles.** While executing the drillings and the cut-out metal particles are catapulted.*



Wear eye protection

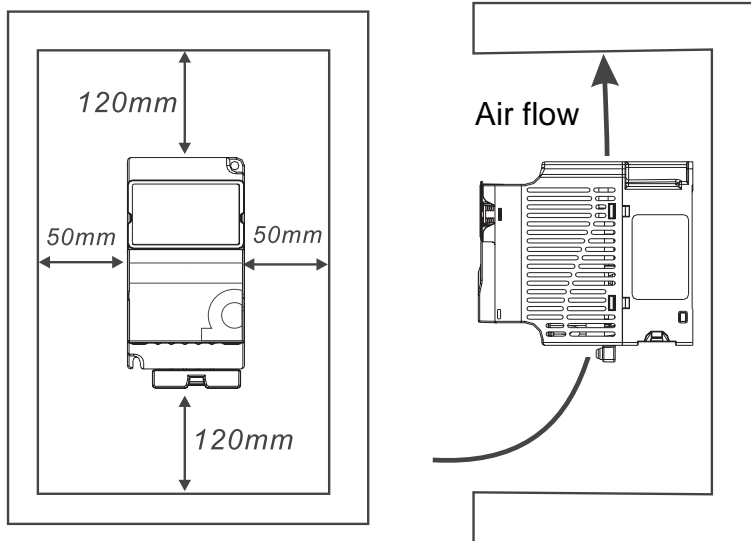
- h Please carry only fully assembled **b maXX® 1000** to prevent machine damage.
- h Execute the drilling and if necessary the cut-outs.
- h Mount the **b maXX® 1000** vertically on a flat vertical surface by using bolts or screws. Other directions are not allowed.
- h The **b maXX® 1000** will generate heat during operation. Allow sufficient space around the unit for heat dissipation.
- h The heat sink temperature may rise to 90°C when running. The material on which the **b maXX® 1000** is mounted must be noncombustible and be able to withstand this high temperature.
- h When the device is installed in a confined space (e.g. cabinet), the surrounding temperature must be within 10 to 40°C with good ventilation. DO NOT install the device in a space with bad ventilation.
- h When installing multiple devices **b maXX® 1000** in the same cabinet, they should be adjacent in a row with enough space. When installing one **b maXX® 1000** below another one, use a metal separation barrier between the **b maXX® 1000** to prevent mutual heating. Refer to figure below for details.
- h Prevent fiber particles, scraps of paper, saw dust, metal particles, etc. from adhering to the heatsink.

5.4 Installation space

The following drawings show the main dimensions of the devices in mm. Use these drawings, in order to determine the required space in the control cabinet. For the construction of the necessary drilling/cut-outs use the drawings in [ZDimensions](#)— from page 39.

5.4.1 Installation space frame 1

Option 1 (-10 to +50°C)



Option 2 (-10 to +40°C)

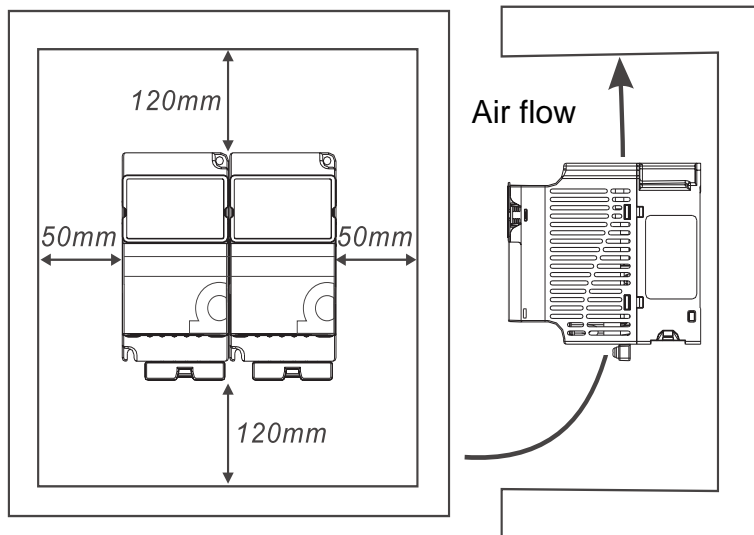
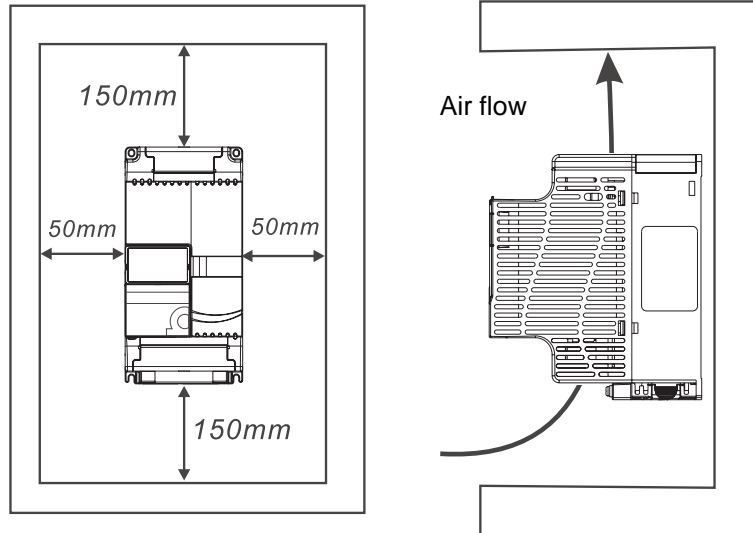


Figure 14: Installation space frame 1

5.4.2 Installation space frame 2 and 3

Option 1 (-10 to +50°C)



Option 2 (-10 to +40°C)

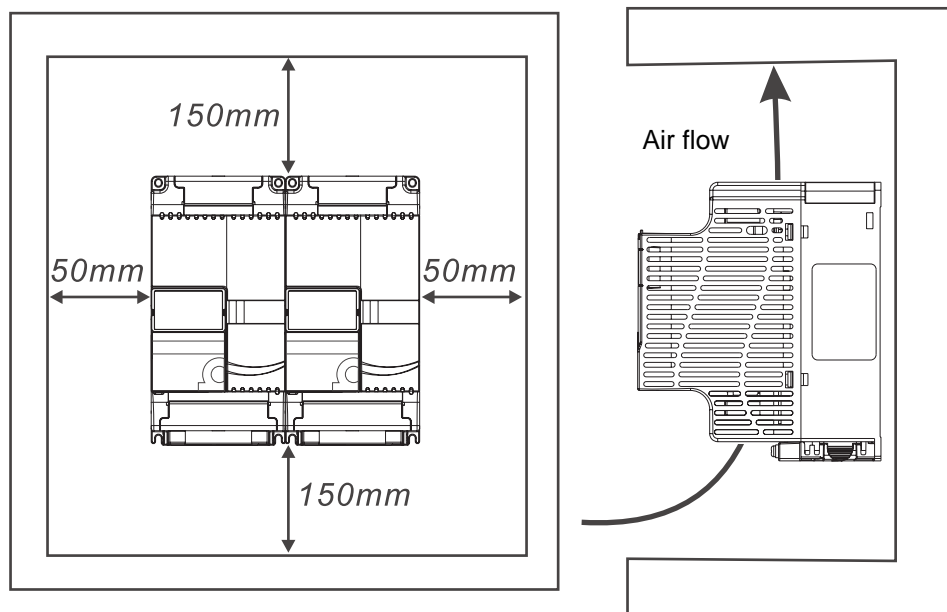


Figure 15: Installation space frame 2 and 3

5.4 Installation space

5.4.3 Installation with metal separation

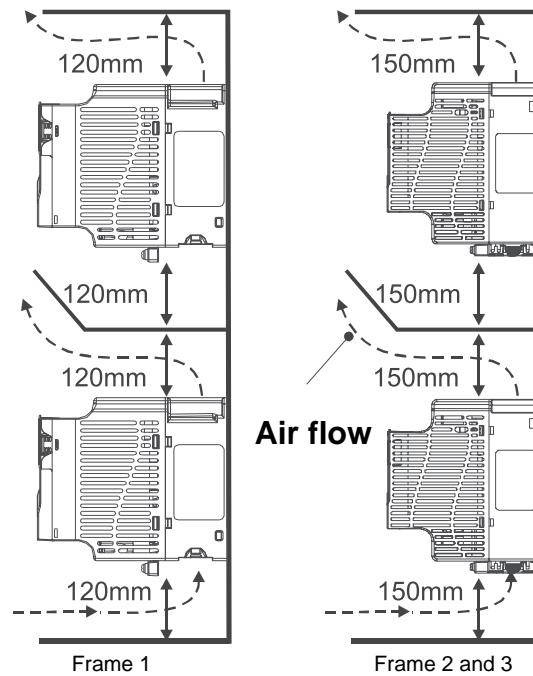


Figure 16: Installation with metal separation

5.4.4 Installation without metal separation

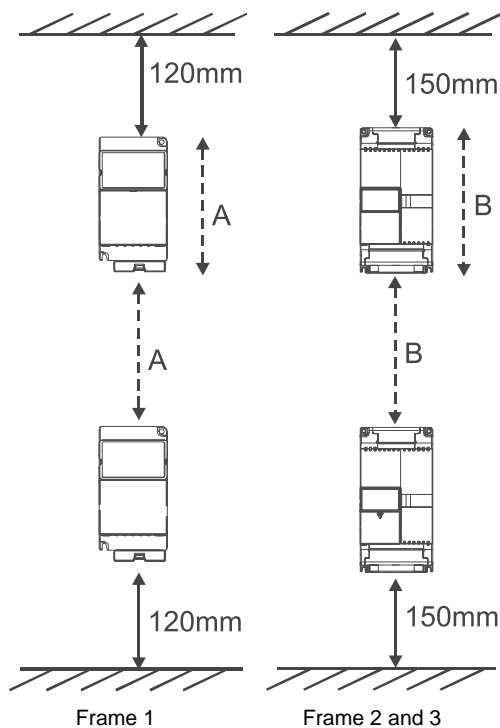


Figure 17: Installation without metal separation

5.5 Dimensions

The following drawings show the dimensions of the devices. Use these drawings, to prepare the necessary drilling/cut-outs. Use the drawings under [ZInstallation space](#)— from page 36, to determine the required space in the control cabinet.

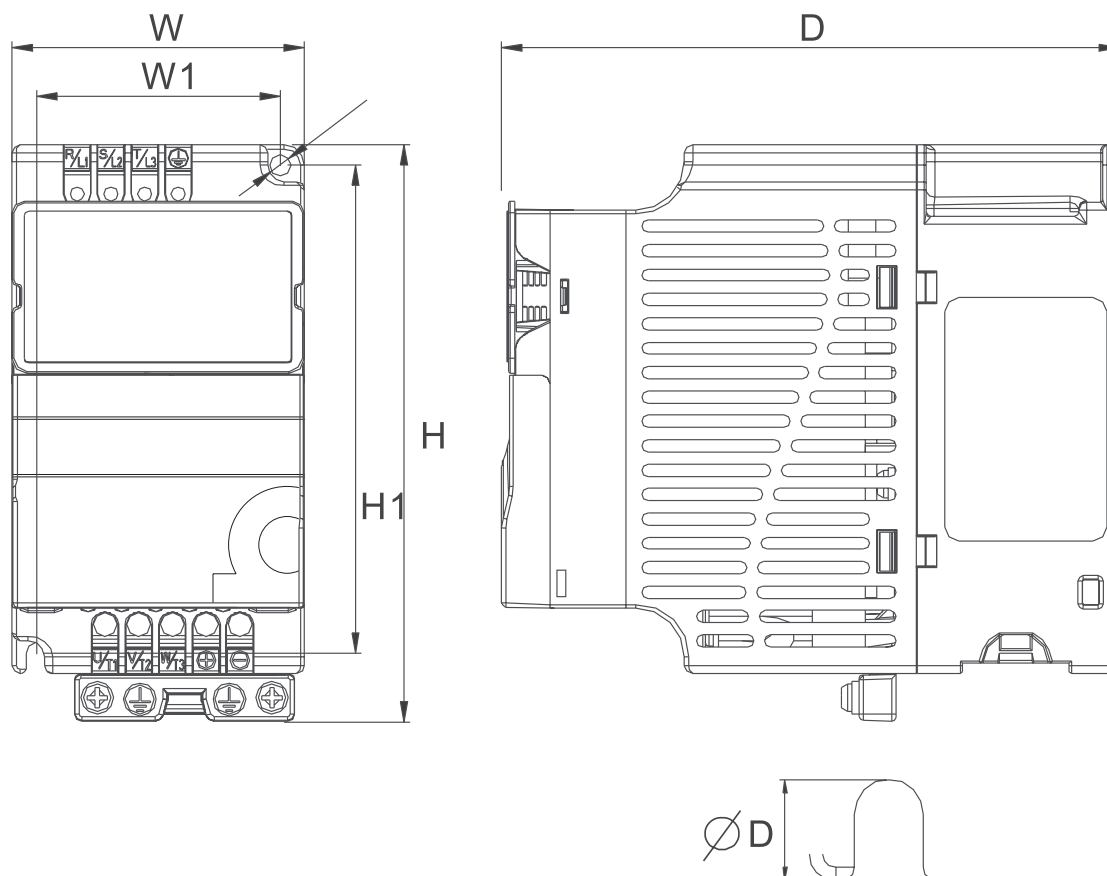


Figure 18: Dimensions

| Frame | W | W1 | H | H1 | D | Ø | DØ |
|-------|-------|-------|-------|-------|-------|-----|-----|
| 1 | 72.0 | 60.0 | 142.0 | 120.0 | 152.0 | 5.2 | 7.6 |
| 2 | 100.0 | 89.0 | 174.0 | 162.0 | 152.0 | 5.5 | 9.3 |
| 3 | 130.0 | 116.0 | 260.0 | 246.5 | 169.0 | 5.5 | 9.8 |

5.6 Mounting instructions

m Operation terminal (option keypad):



Depth: 28,8 mm

Figure 19: Dimension operation terminal

5.6 Mounting instructions



CAUTION

The following **may occur**, if you disregard these safety notes:

m minor to medium personal injury.

*The danger is: **sharp edges**. In case, while installing, you lift a device with unprotected hands, fingers/palm can be cut. If the device falls off, the feet can be cut.*



Wear safety gloves



Wear safety shoes

Complete the mounting in the following way:

- 1 provide suitable mounting accessories
- 2 mount the device.

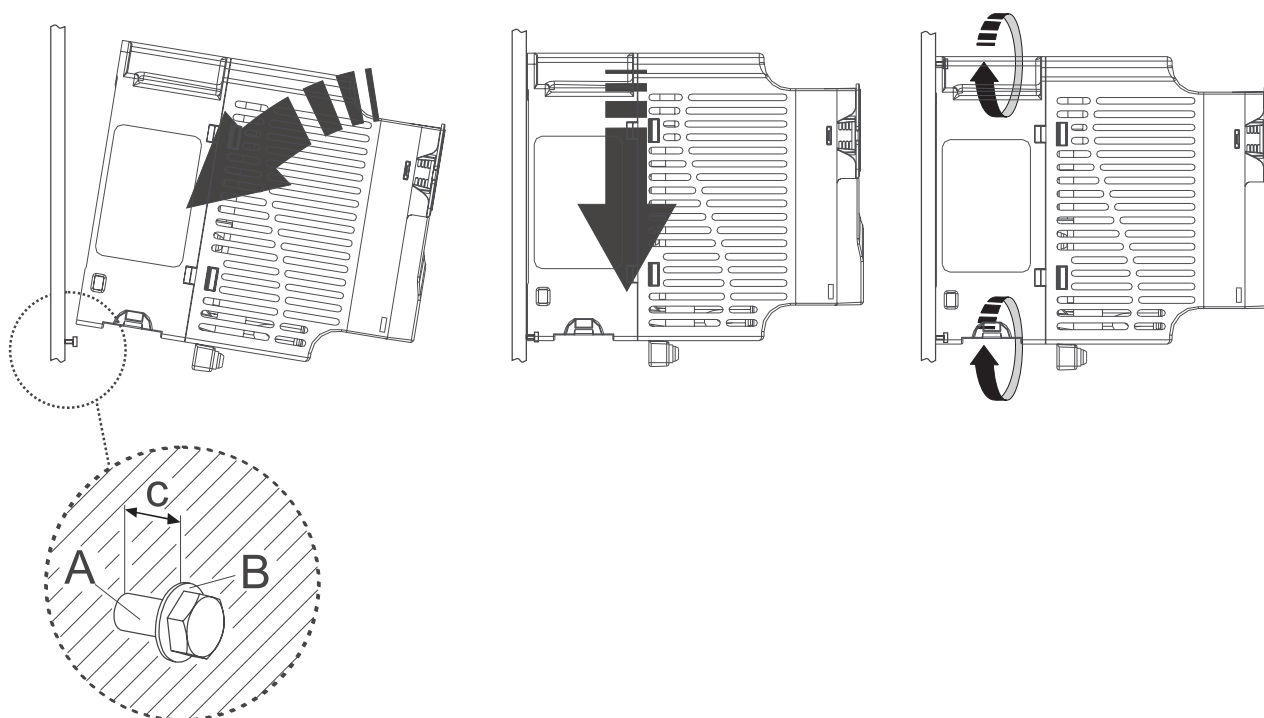


Figure 20: Mounting instruction

| Device | Frame 1 | Frame 2 | Frame 3 |
|-------------------|----------------|----------------|----------------|
| A - screws | 2 x M4 | 4 x M4 | 4 x M5 |
| B - washers | 2 x (4.3 x 10) | 4 x (4.3 x 10) | 4 x (5.3 x 10) |
| C - mount spacing | c = 12 mm | c = 12 mm | c = 16 mm |



NOTE

Spare parts for DIN-rail mounting see [ZB.8 DIN rail](#)— on page 134.

INSTALLATION

In this chapter we describe the electric installation of the device. The mechanical installation is described in [ZMounting](#)— from page 33.

Before installing assure, that the technical preconditions are fulfilled:

- 1 Check the requirements to the electrical mains and check if the existing mains is suitable.
- 2 Check the requirements to the electrical cables and provide the according cables.
- 3 Check the characteristics of the connections and configure the connections accordingly.

6.1 General safety instructions

- h Pay attention to the information in the chapters [ZFundamental safety instructions](#)— from page 11.
- h Pay attention to all areas at the device, which could be dangerous for you during the electrical installation.



Figure 21: Danger areas at the electrical installation

6.2 Requirements to the executing personnel



WARNING

The following **may occur**, if you disregard these safety notes:

m serious personal injury m death



*The danger is: **electricity**. When operating with this electrical unit, inevitably certain parts of this unit are under dangerous voltage.*

Make sure, that only qualified personnel, who are familiar with the safety- as well as with mounting-, operating- and maintenance instructions, work on this unit.

At each case qualified personnel are persons, who are authorized by the responsible persons, to execute necessary actions and who recognize the possible dangers and who are able to avoid these dangers. They have had the training, the experience, they were given instructions as well as knowledge about the relevant standards and instructions, they have knowledge of the accident prevention regulations and of the operating environments. The required qualifications for the work with this unit are for example:

- m Education or instruction or to have the authorization to put into operation, ground and label circuits and devices according to the standards of safety engineering.
- m Training or instruction due to the standards of the safety engineering in maintenance and use of appropriate safety equipment.

6.3 Requirements to the electrical mains

All important data is to be found in [ZD.3 Electrical data](#)— on page 143. Small deviations of the electrical mains from the requirements can lead to malfunctions of the device. In case the mains deviates strongly from the requirements, the device can be destroyed. **b maXX® BM1000**-devices must not be operated in low-voltage mains in order to supply buildings in residential areas. The destruction of the device can cause personnel injury.



WARNING

The following **may occur**, if you disregard these safety notes:

m serious personal injury m death



*The danger is: **electricity**. In case you do not ensure the requirements to the electrical mains, the device can be damaged/destroyed and can thereby endanger persons severely.*

Assure before installation, that the requirements of the electrical mains are fulfilled.

6.4 Requirements to the connecting cables

- h Always use shielded cables
- h You must consider IEC/EN 60204-1, chapter 13 at selection of connection cables.
- h The protective conductor cross section of the cable must be executed accordant to IEC/EN 60204-1, section 5.2, tab. 1.
- h The permanent connection of the protective conductor is imperatively regulated for the operation of the device.
- h Use a copper cable for at least 60°C (drives < 3 x 100 A) incase you consider UL 508 C.

6.5 Protection of the device and of the cable respectively

In order to protect the device or the cables against damage/destruction by the mains, you must install fuses. Data of the necessary fuses are to be found in [ZD.5 Fuse protection](#)— from page 146.

6.6 PE connection and RCD compatibility

Due to the operating principle leakage current can flow via the protective conductor $> 3.5 \text{ mA}_{AC}$ or $> 10 \text{ mA}_{DC}$. On this account a permanent protective conductor is prescribed. In addition to the plugged protective connection, the screw terminal, which is marked with „PE“ must be connected to the PE (see [ZConnection diagrams](#)— from page 48).

WARNING



The following **may occur**, if you disregard these safety notes:

m serious personal injury m death

This product can cause direct current in the protective conductor. If, in case of a direct or indirect contact a residual-current-operated protective device (RCD) is used, then a RCD of type B is permitted on the power supply side only. Otherwise other safety precautions must be made as e. g. environmental separation with a double or strengthened insulation or by the separation of the power supply with an isolated transformer.

Due to high leakage currents, which arise due to the operating principle of the device, can result in an early enabling of the RCD or generally can avoid an enable.

6.7 Requirements on the laying (EMC notes device)



NOTE

The emission of radio interferences is to a high level dependent on the wiring, the volume expansion and the arrangement of the components in the installation. That is why the assurance of the electromagnetic compatibility according to the statutory provisions only is possible on the completed installation and therefore is in the responsibility range of the manufacturer of the installation or of the operating authority (EMVG § 6, sec. 9).



NOTE

In this Manual the most important information for an EMC-compatible installation is available. Further notes, which necessarily have to be considered in order to mount a CE-conform installation are to be found in the manual 'filters for mains applications'.

- m Use Baumüller motor cables (shielded) and Baumüller components.
- m Use a suitable mains filter of Baumüller Nürnberg GmbH
- m Mount all components to one single mounting board with well electroconductive surface (e. g. galvanized steel plate).
- m Execute the ground connection converter/ground plane as short as possible (< 30 cm) with fine-wired cables and a great cross section (> 10 mm²).
- m When installing, attend to the correct order:
Mains - fuse -mains reactor - filter - **b maXX[®] 1000** - motor)
- m Assure, that the motor cables always consist of one piece.
Do not interrupt the motor cables e. g. by terminals, contactors, fuses a.s.o.
- m Run the cables directly on the surface of the grounded mounting board.
(smallest possible effective aerial height).
- m Keep a minimum clearance of 20 cm between signal and control wires towards electric power cables at parallel laying.
- m Cross cables with different EMC categories (signal cables - supply cables or motor cables) only in a 90° angle.
- m Contact the external cable screens when passing through walls, which separate different EMC ranges.
- m Connect the cable shields of the **b maXX[®]**-devices plane on both ends and highly conductive with ground.

6.8 Operating sequence of installation



WARNING

The following **may occur**, if you disregard these safety notes:

m serious personal injury m death

*The danger is: **electricity**. Parts, which are under tension are perilous.*

Assure, that during the entire mounting the device, the parts, which must be mounted (e. g. supply cables) and the mounting range are off-circuit.

All the units must be grounded directly to a common ground terminal to prevent electric shock, fire and interference.

The following steps must be carried out at installation:

1 Lay all cables EMC-compatible.

2 Connect cables (see [ZConnection diagrams](#)— from page 48)

m Connect the motor via the terminals U/T1, V/T2, W/T3, PE. Attend to the in-phase connection (rotational direction).

m Connect the fuses.

(in case you consider UL 508 C: use the semiconductor- or total-range-fuses, which are UL-listed in chapter [ZD.5 Fuse protection](#)— from page 146.)

m Connect the mains filter (if necessary).

m Connect the reactors (if necessary)

m Connect the device via the mains input terminals R/L1, S/L2 and T/L3.

m Connect the protective conductor to the terminal PE (a permanent PE connection is required imperatively).

m Perhaps connect (dependent on the application) a braking resistor (R_B) or a chopper unit.



NOTE

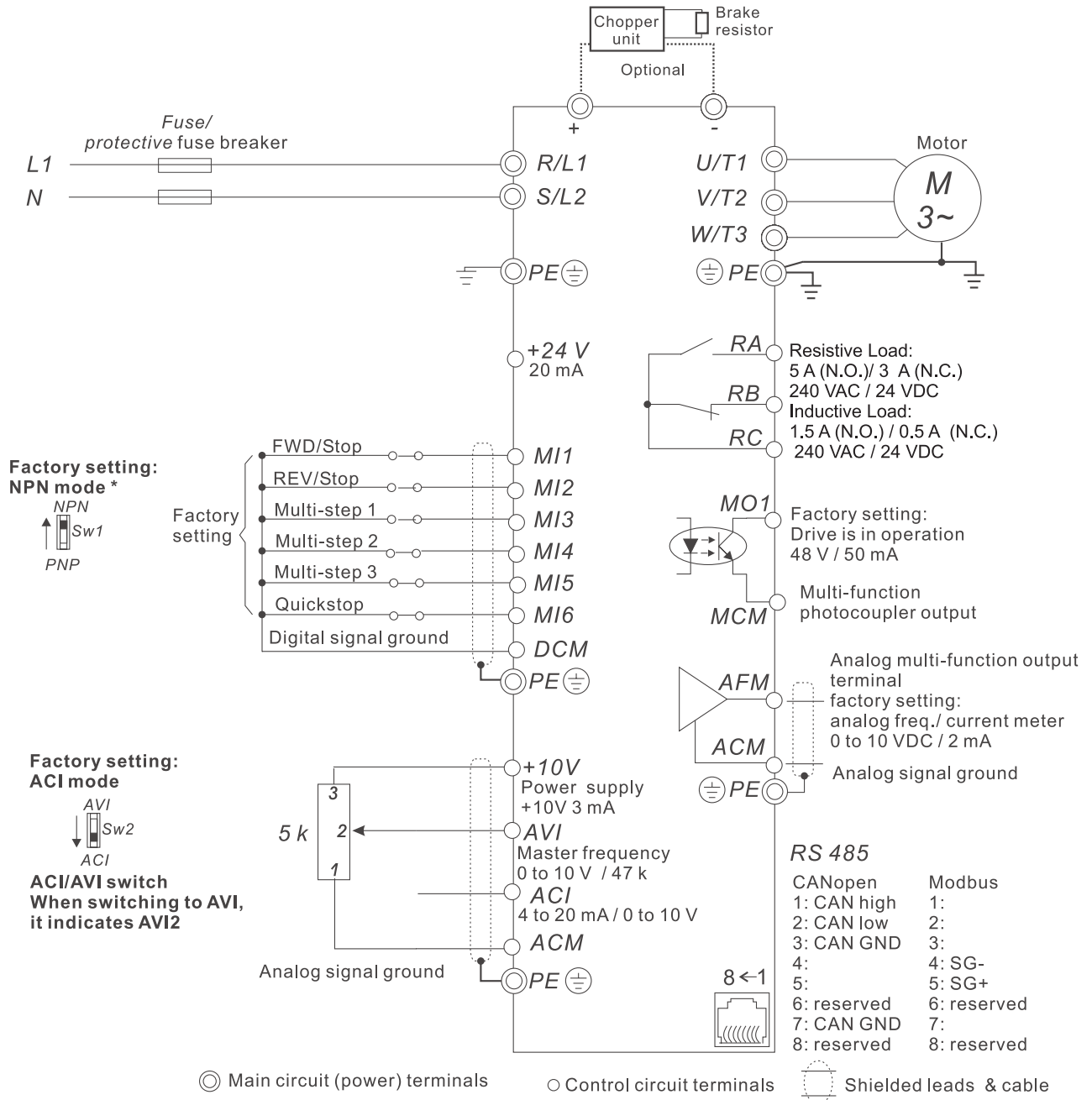
Users must connect wires according to the circuit diagrams on the following pages.

Always use shielded cables.

Do not plug a modem or telephone line to the RS-485 communication port or permanent damage may result. Terminals 1 and 2 are the power supply for the optional copy keypad only and should not be used for RS-485 communication.

6.9 Connection diagrams

m BM1211, BM1212, BM1213



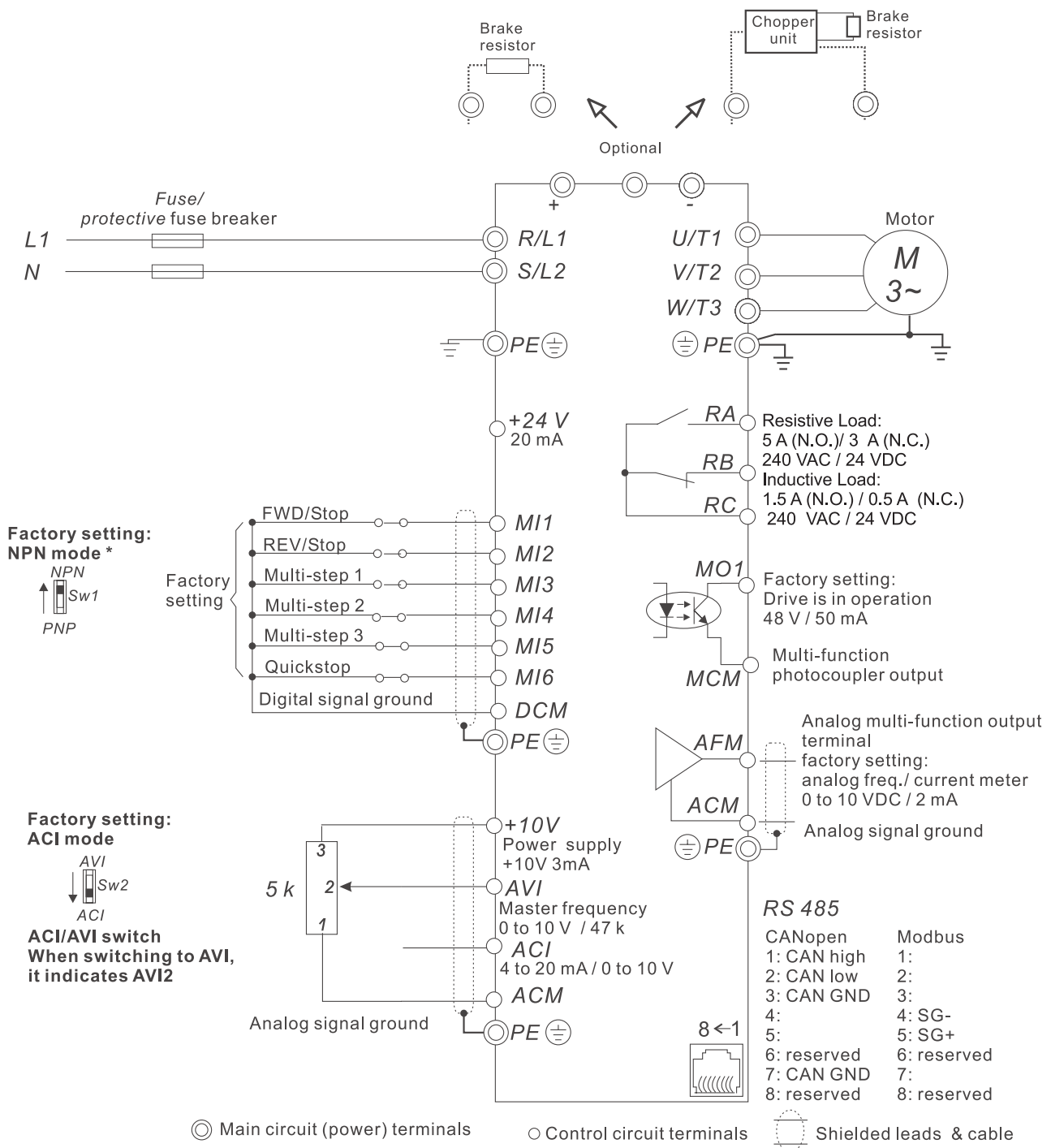
*: Please refer to [ZFigure 22–](#) on page 52 for wiring of NPN mode and PNP mode.

NOTE



Single-phase models can only use R/L1, S/L2 to be the power terminals.
Single-phase power cannot be used for 3-phase models.

m BM1224, BM1225



*: Please refer to [ZFigure 22–](#) on page 52 for wiring of NPN mode and PNP mode.

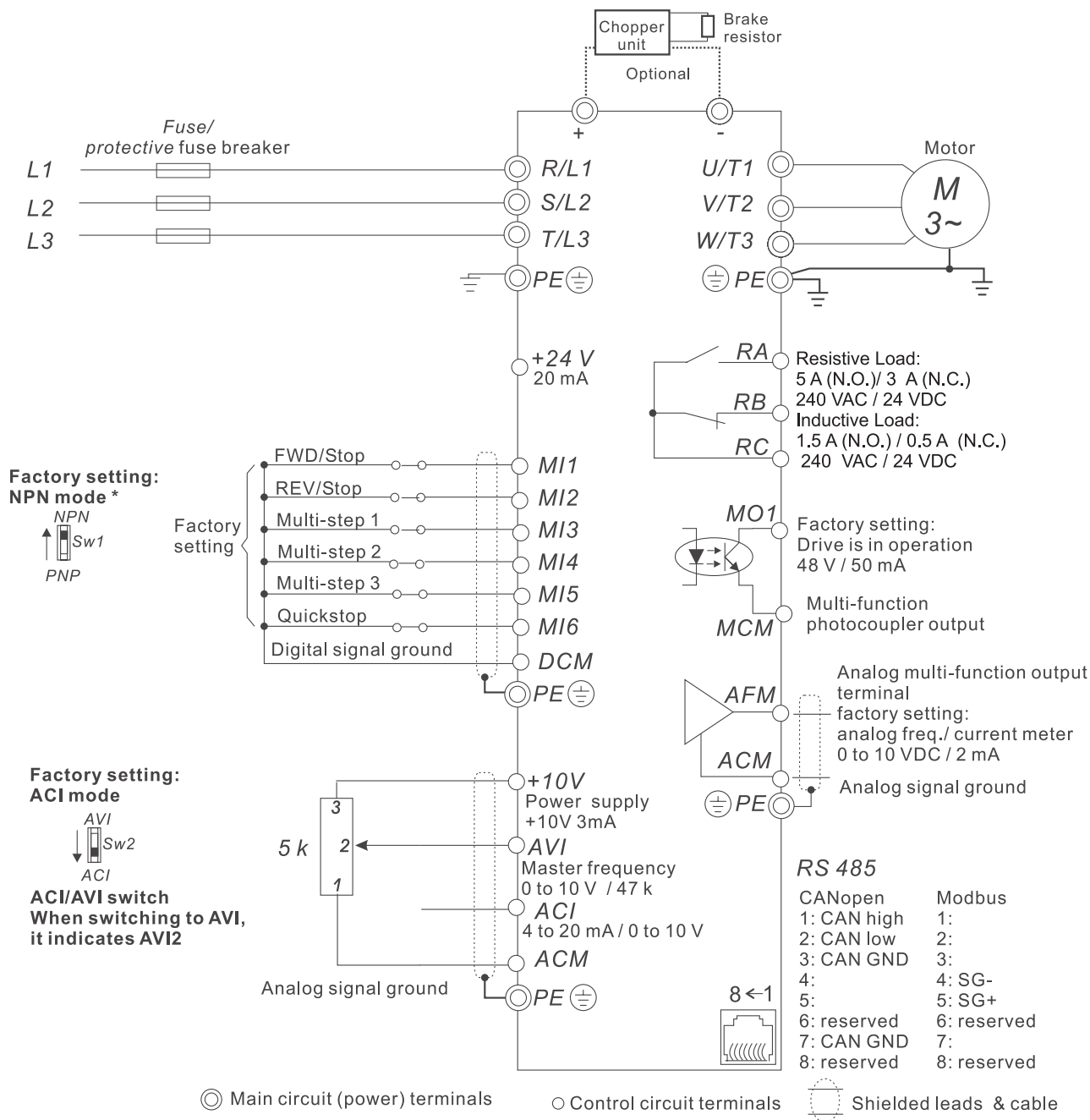
NOTE

Single-phase models can only use R/L1, S/L2 to be the power terminals.
Single-phase power cannot be used for 3-phase models.



6.9 Connection diagrams

m BM1412, BM1413, BM1414



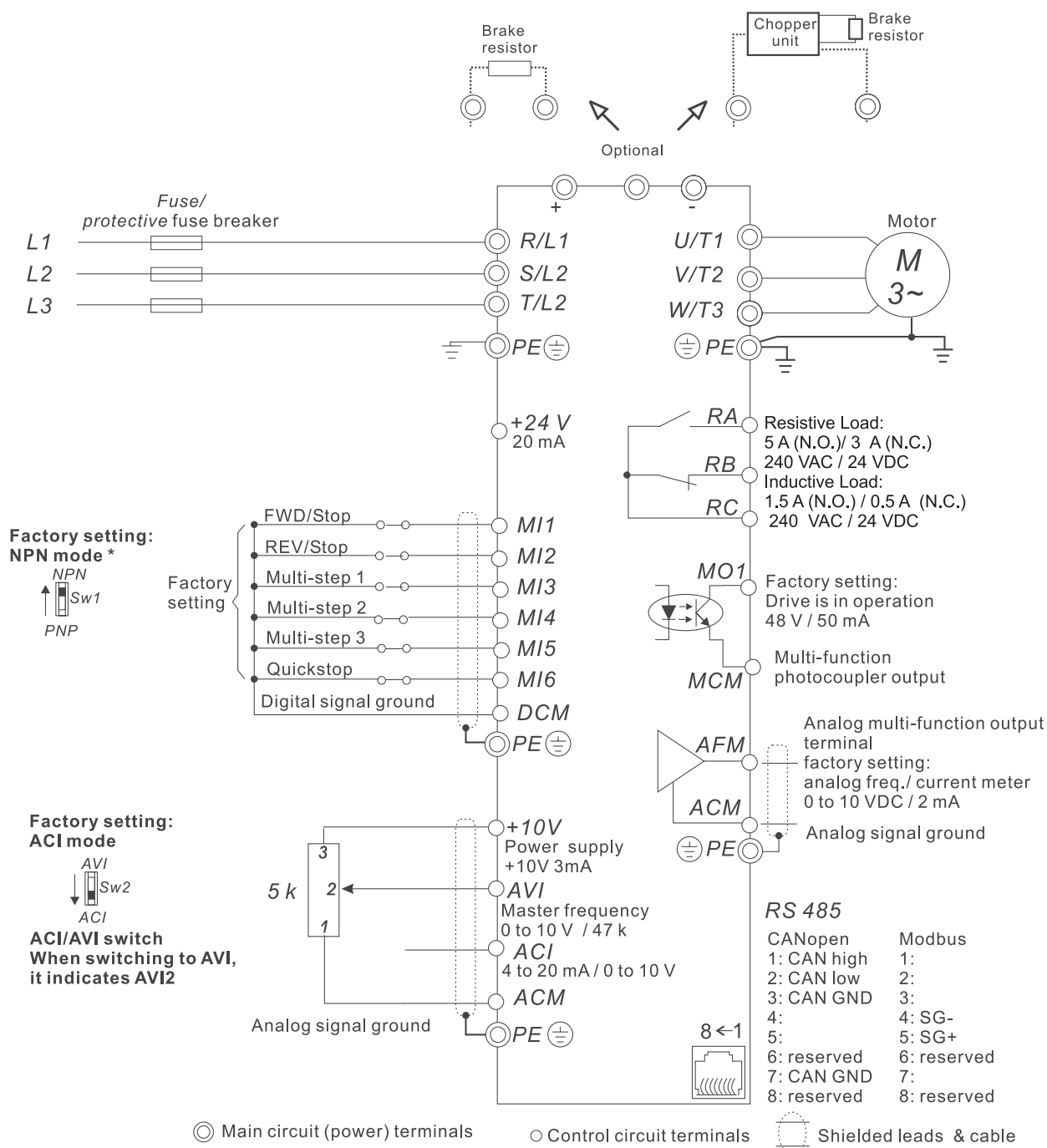
*: Please refer to ZFigure 22– on page 52 for wiring of NPN mode and PNP mode.

NOTE



Single-phase models can only use R/L1, S/L2 to be the power terminals.
Single-phase power cannot be used for 3-phase models.

m BM1425, BM1426, BM1437, BM1438, BM1439



*: Please refer to [ZFigure 22](#) on page 52 for wiring of NPN mode and PNP mode.

NOTE

Single-phase models can only use R/L1, S/L2 to be the power terminals.

Single-phase power cannot be used for 3-phase models.



Connection diagrams

Wiring for NPN mode and PNP mode

m without external power

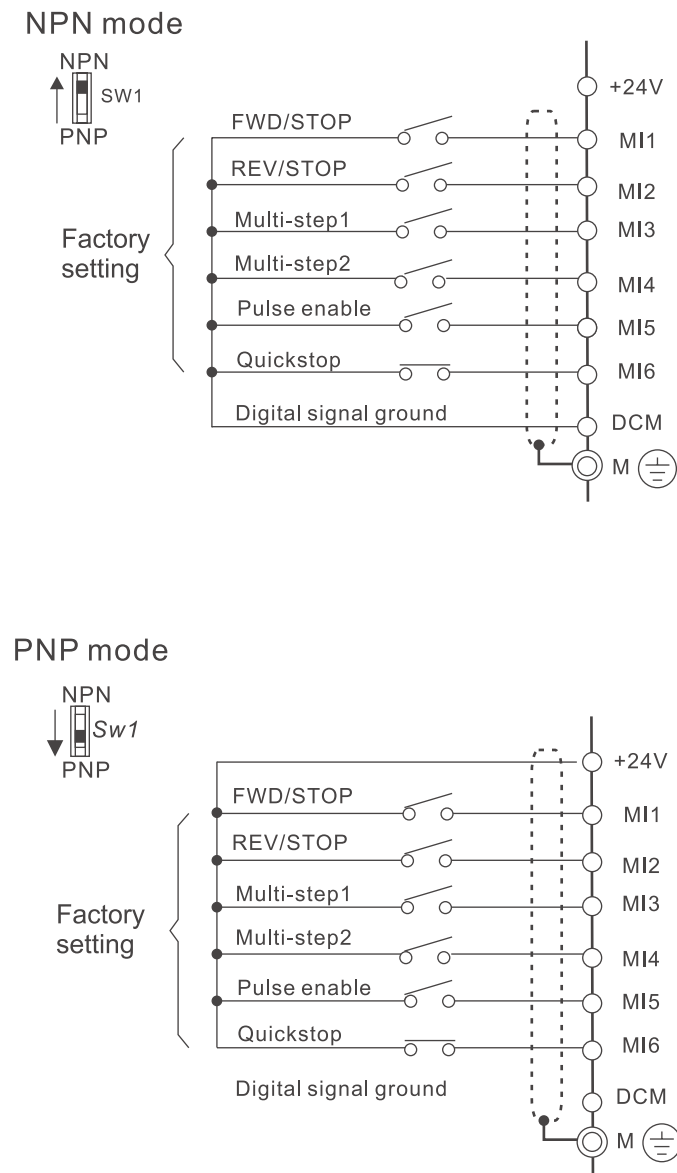


Figure 22: Connection NPN mode and PNP mode - without external power

m with external power

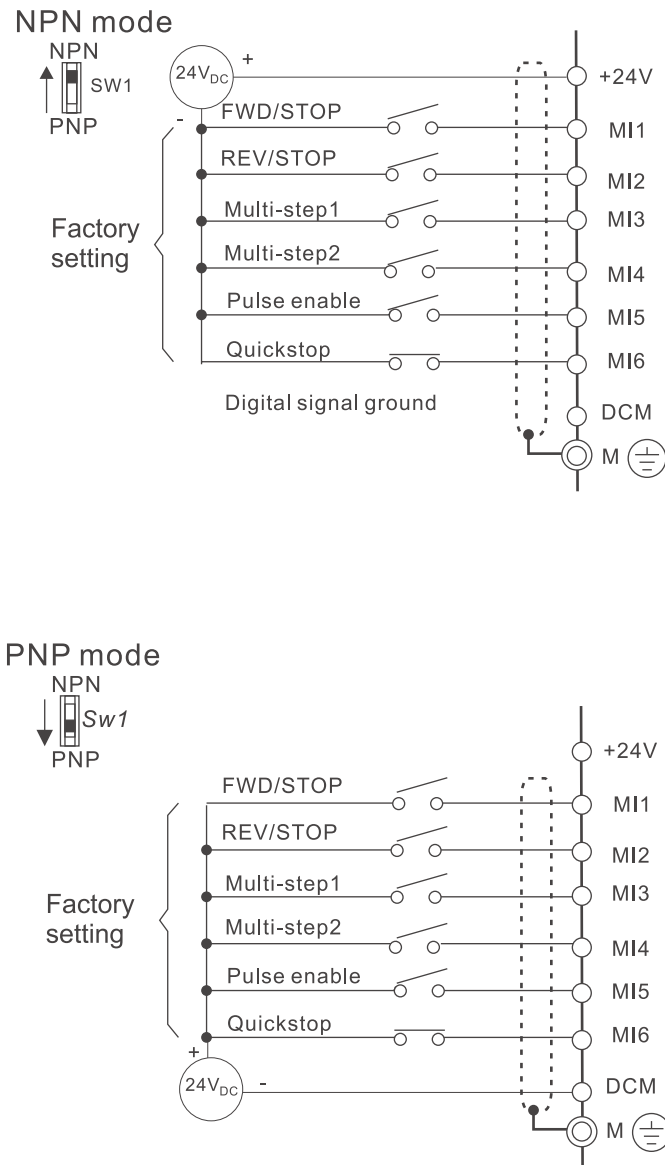


Figure 23: Connection NPN mode and PNP mode - with external power

6.10 External connections

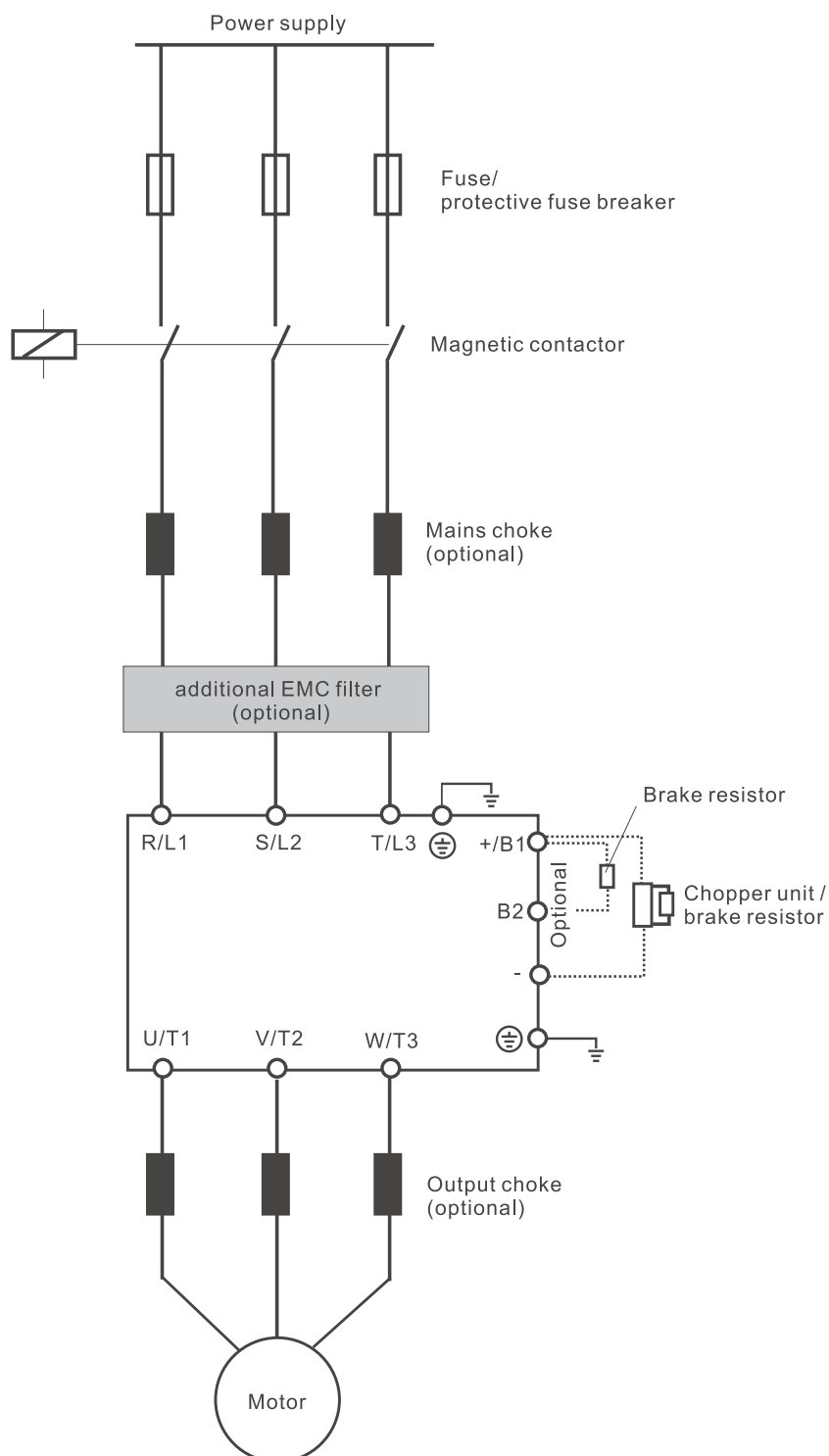
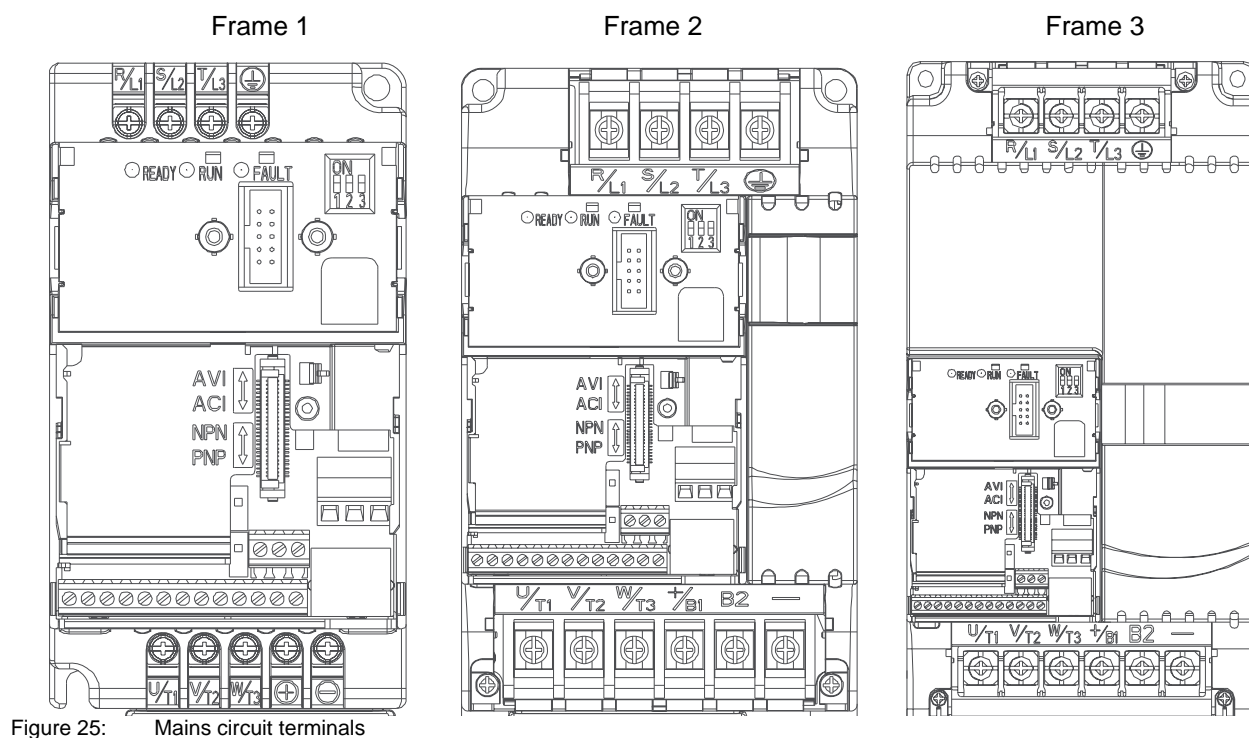


Figure 24: External connections

| Items | Explanations |
|--|---|
| Power supply | Please follow the specific power supply requirements shown in ZD.3 Electrical data — from page 143 |
| Fuse/protective fuse breaker (optional) | There may be an inrush current during power up. Please check the chart of ZD.5 Fuse protection — from page 146 and ZB.4 Fuses for device-protection — on page 132 to select the correct fuse. Use of an protective fuse breaker is optional. |
| Magnetic contactor (optional) | Please do not use a magnetic contactor to switch on/off the b maXX® BM1000 during device operation, as it will reduce the operating life cycle of the device. |
| Mains choke (optional) | Used to improve the input power factor, to reduce harmonics and provide protection from mains interferences. (surges, switching spikes, short interruptions, etc.). The mains choke should be installed when the power supply capacity is 500 kVA or more and exceeds 6 times the device capacity, or the mains wiring distance ≤10 m. See Z6.15 Applications for mains chokes — on page 69 and ZB.3.1 Mains chokes recommended values — on page 130 for further information. |
| Additional EMC filter (optional) | To reduce electromagnetic interference. NOTE The models b maXX® 1000 have an built-in EMI filter. An additional mains filter is necessary for cable lengths > 15 m (cable device - motor). For further information see ZB.2 Mains filters — on page 129. |
| Chopper unit/braking resistor (optional) | Used to reduce the deceleration time of the motor. m Frame 1: No built-in chopper unit: Use of chopper unit and braking resistor necessary (refer to ZB.1.1 Select a chopper unit /braking resistor — from page 120). m Frame 2 and 3: Built-in chopper unit: Connection of a suitable braking resistor (see ZB.1.1 Select a chopper unit / braking resistor — from page 120) possible. If the motor generates additional regeneration energy a further chopper unit with braking resistor can be connected. |
| Output choke (optional) | Motor surge voltage amplitude depends on motor cable length. For applications with long motor cable, it is necessary to install a choke at the device output side. 230V 1-phase: 0,4 kW and smaller: max 15 m. 0,75 kW and higher: max 50 m. 400V 3-phase: 0,75 kW and smaller: max 20 m. 1,5 kW and higher: max 50 m. For more information see ZB.3.2 Output chokes recommended values — on page 131. |

6.10.1 Specifications of main circuit terminals



| Frame | Power terminals | Torque | Wire | Wire type |
|-------|--------------------------|--------|--|-----------------------|
| 1 | R/L1, S/L2, T/L3 | 1.4 Nm | 12-14 AWG, (3.3-2.1 mm ²) | Copper only, 75° C |
| | U/T1, V/T2, W/ T3, PE | | | |
| 2 | R/L1, S/L2, T/L3 | 1.8 Nm | 8-18 AWG, (8.4-0.8mm ²) | Copper only, 75° C |
| | U/T1, V/T2, W/ T3 | | | |
| | +B1, B2, -, PE | | | |
| 3 | R/L1, S/L2, T/L3 | 3.0 Nm | 8-16 AWG, (8.4-1.3mm ²) | Copper only, 75° C |
| | U/T1, V/T2, W/ T3 | | | |
| | +B1, B2, -, PE | | | |

6.10.2 Connecting main terminals

- m Frame 1 (BM1211, BM1212, BM1213, BM1412, BM1413, BM1414):
No built-in chopper unit:
Optional use of chopper unit and braking resistor necessary (refer to [ZB.1.2 Chopper units BM1-BTE](#)— from page 121 and [ZB.1.3 Dimensions and weights for braking resistors](#)— from page 127).
- m Frame 2 and 3 (BM1224, BM1225, BM1425, BM1426, BM1437, BM1438, BM1439):
Built-in chopper unit:
Optional connection of a suitable braking resistor (see [ZB.1.3 Dimensions and weights for braking resistors](#)— from page 127) possible.
If the motor generates additional regeneration energy a further chopper unit with braking resistor can be connected.

- m BM1211, BM1212, BM1213 (Frame 1)

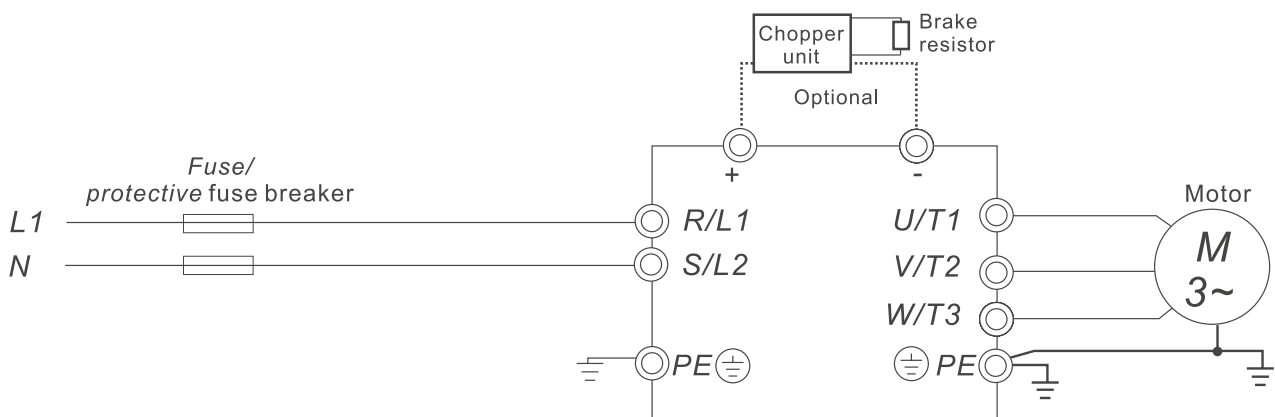


Figure 26: Mains terminals connections 1

- m BM1224, BM1225 (Frame 2)

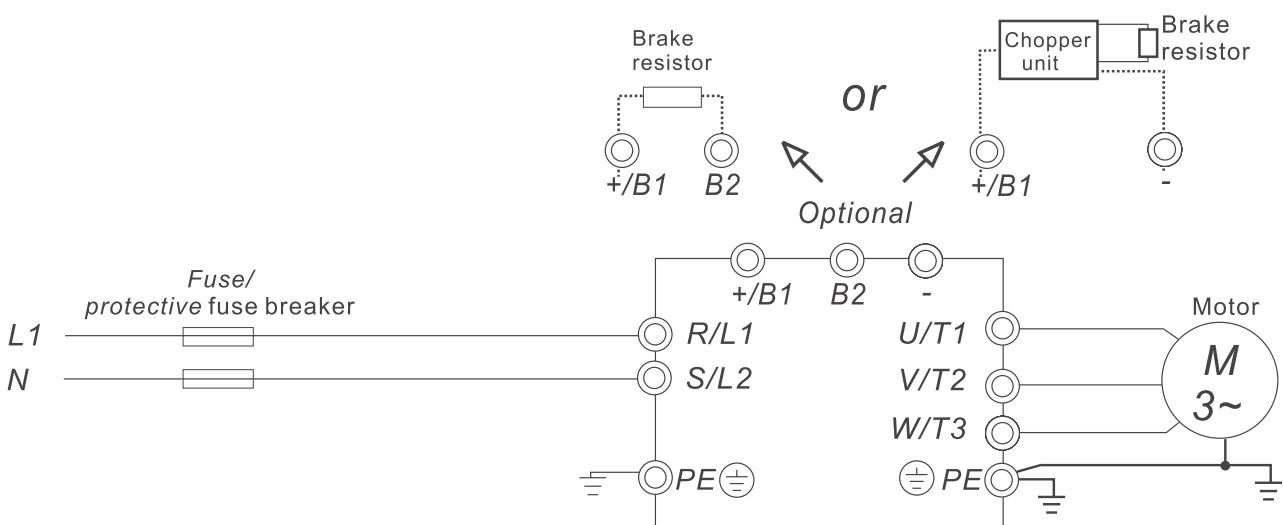


Figure 27: Mains terminals connections 2

6.10 External connections

m BM1412, BM1413, BM1414 (Frame 1)

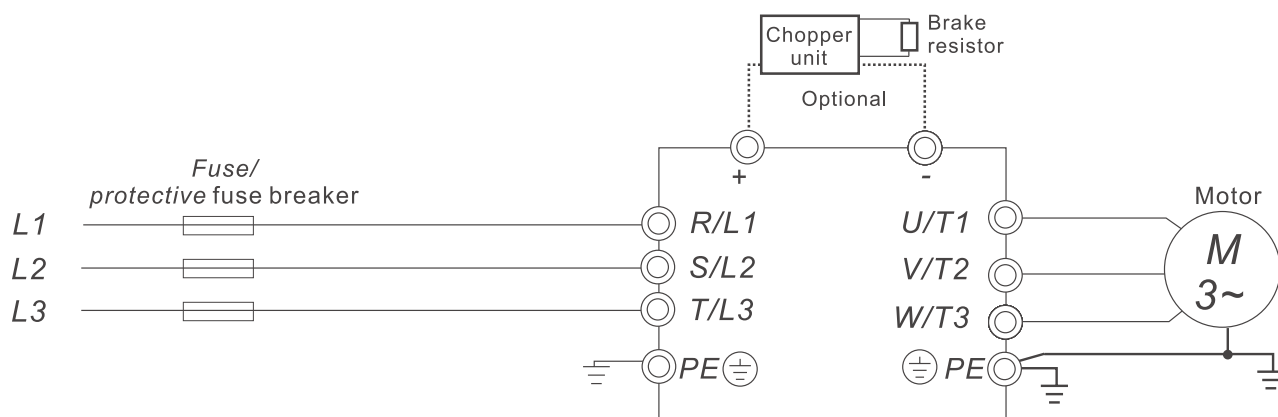


Figure 28: Main terminals connections 3

m BM1425, BM1426, BM1437, BM1438, BM1439 (Frame 2)

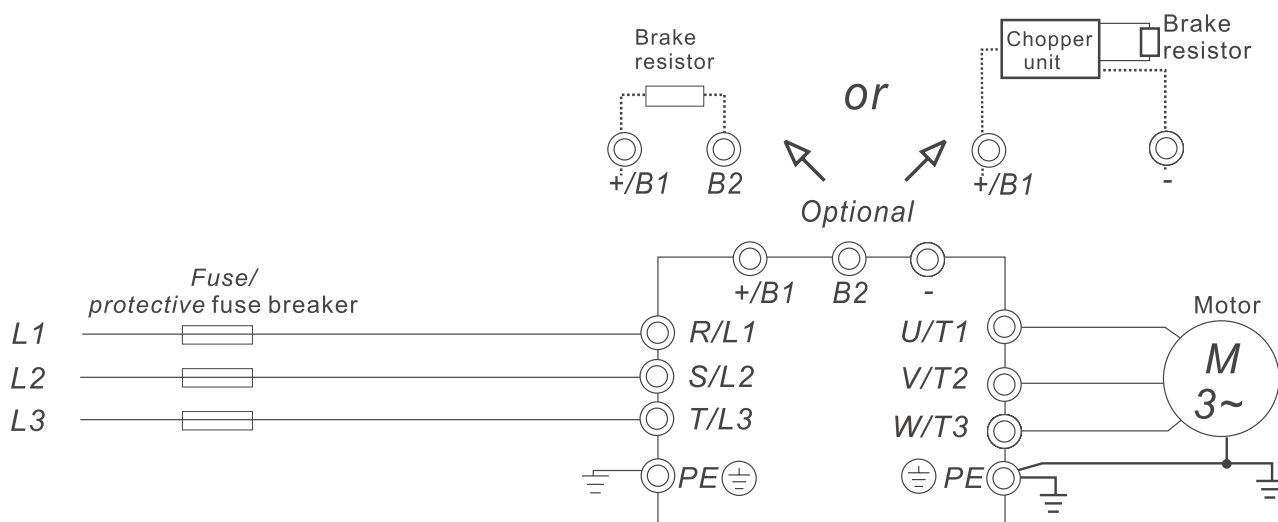


Figure 29: Main terminals connections 4

| Terminal Symbol | Explanation of Terminal Function |
|------------------|---|
| R/L1, S/L2, T/L3 | Input terminals (1-phase/3-phase) |
| U/T1, V/T2, W/T3 | Output terminals for connecting 3-phase motor |
| +/B1, B2 | Connections for braking resistor (optional) |
| +/B1, - | Connections for external chopper unit (optional) |
| ⊕ | Earth connection, please comply with local regulations. |

6.10.3 Mains power terminals (R/L1, S/L2, T/L3)

- ☐ Connect these terminals (R/L1, S/L2, T/L3) via a protective fuse breaker or earth leakage breaker to 3-phase mains power (some models to 1-phase mains power) for circuit protection. It is unnecessary to consider phase-sequence.
- ☐ It is recommended to add a magnetic contactor in the power input wiring to cut off power quickly and reduce malfunction when activating the protection function of **b maXX® BM1000**. Both ends of the magnetic contactor should have an R-C surge absorber.
- ☐ Please make sure to fasten the screw of the main circuit terminals to prevent sparks which is made by the loose screws due to vibration.
- ☐ When using a GFCI (Ground Fault Circuit Interrupter), select a current sensor with sensitivity of 200 mA, and not less than 0.1-second detection time to avoid nuisance tripping.
- ☐ Do NOT run/stop the **b maXX® BM1000** by turning the power ON/OFF. Run/stop the **b maXX® BM1000** by RUN/STOP command via control terminals or keypad. If you still need to run/stop the **b maXX® BM1000** by turning power ON/OFF, it is recommended to do so only ONCE per hour.
- ☐ Do NOT connect 3-phase models to a 1-phase power source.

NOTE



No T/L3 terminal on 1-phase models

6.10.4 Output terminals (U/T1, V/T2, W/T3)

- ☐ The factory setting of the operation direction is forward running. The methods to control the operation direction are: method 1, set by the communication parameters, method 2, control by the optional keypad.
- ☐ When the **b maXX® 1000** output terminals U/T1, V/T2, and W/T3 are connected to the motor terminals U/T1, V/T2, and W/T3, respectively, the motor will rotate counterclockwise (as viewed on the shaft end of the motor) when a forward operation command is received. To permanently reverse the direction of motor rotation, switch over any of the two motor leads.
- ☐ DO NOT connect phase-compensation capacitors or surge absorbers at the output terminals of the device.
- ☐ With long motor cables, high capacitive switching current peaks can cause over-current, high leakage current or lower current readout accuracy. To prevent this, the motor cable should be less than 20 m for 3.7 kW models and below. And the cable should be less than 50 m for 5.5 kW models and above. For longer motor cables use an output choke.
- ☐ Use a well-insulated motor, suitable for inverter operation.

6.10.5 Terminals [+B1, B2] for connecting chopper unit / braking resistor

- ☐ Connect a braking resistor and/or chopper unit in applications with frequent deceleration ramps, short deceleration time, too low braking torque or requiring increased braking torque.
- ☐ Connect the terminals [+ , -] of the brake unit to the b maXX[®] 1000 terminals [+B1, -]. The length of wiring should be less than 5 m with twisted cable.
- ☐ When not used, please leave the terminals [+B1, -] open.



CAUTION

The following **may occur**, if you do not observe this caution information:

- m Short-circuiting [B2] or [-] to [+B1] can damage the b maXX[®] 1000.

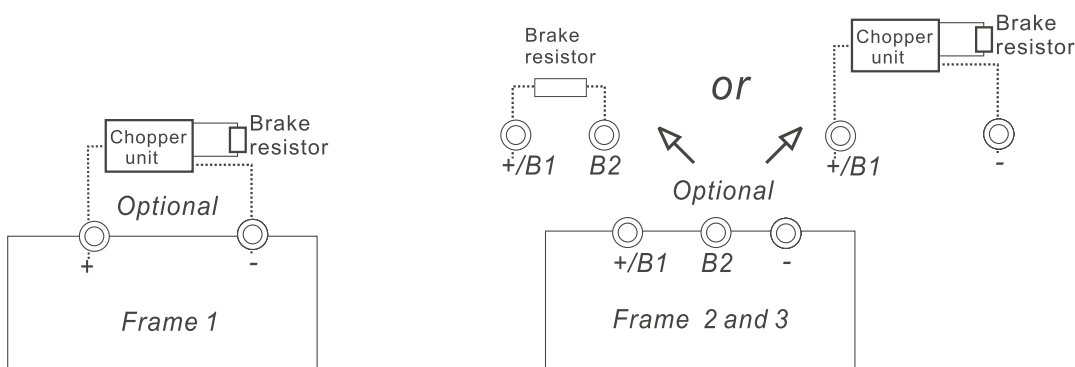


Figure 30: Terminals braking resistor

- m Frame 1 (BM1211, BM1212, BM1213, BM1412, BM1413, BM1414):
No built-in chopper unit:
Optional use of chopper unit and braking resistor necessary (refer to [ZB.1.1 Select a chopper unit /braking resistor](#)– from page 120).
- ☐ Please connect an external chopper unit and braking resistor to the terminal [+ , -], see [ZConnecting main terminals](#)– from page 57.
- m Frame 2 and 3 (BM1224, BM1225, BM1425, BM1426, BM1437, BM1438, BM1439):
Built-in chopper unit:
Optional connection of a suitable braking resistor possible.
If the motor generates additional regeneration energy a further chopper unit with braking resistor can be connected (see [ZB.1.1 Select a chopper unit /braking resistor](#)– from page 120).
- ☐ Please connect the external chopper unit to the terminals [+B1, B2], see [ZConnecting main terminals](#)– from page 57.

6.10.6 Grounding terminals

- ❑ Make sure that the leads are connected correctly and the b maXX[®] 1000 is properly grounded. (Ground resistance should not exceed 0.1Ω.)
- ❑ Use ground leads that comply with local regulations and keep them as short as possible.
- ❑ Multiple b maXX[®] 1000 units can be installed in one location. All the units should be grounded directly to a common ground terminal, as shown in the figure below.

NOTE

Ensure there are no ground loops.

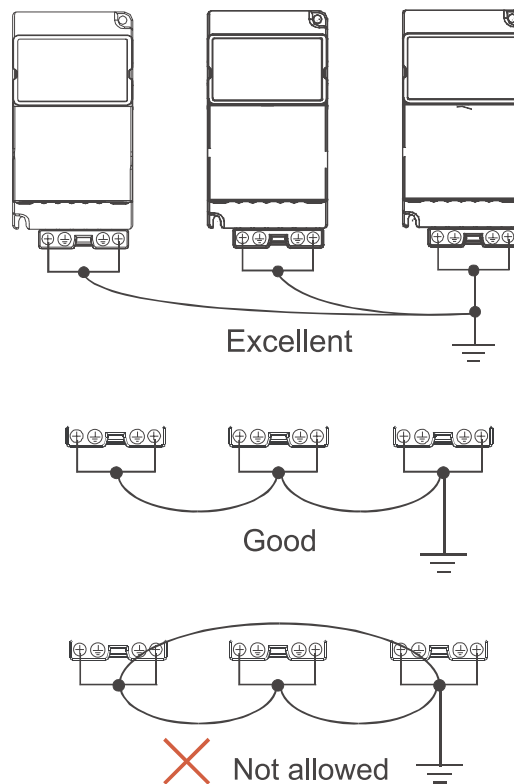
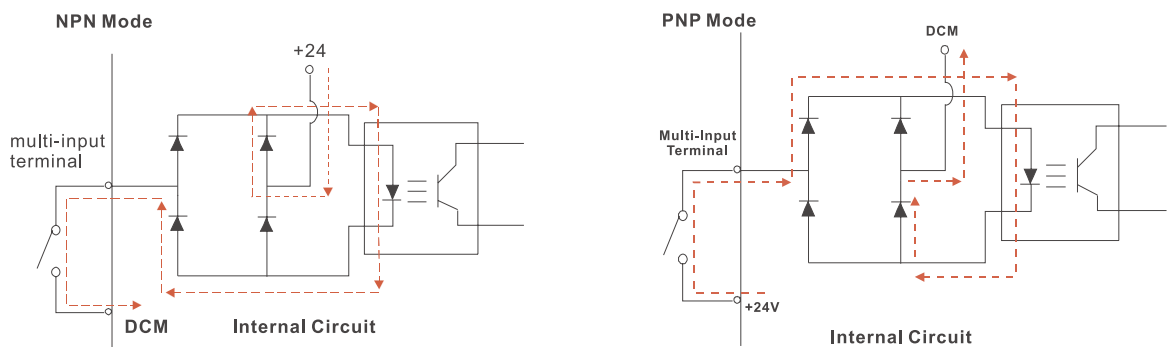


Figure 31: Connecting grounding terminals

6.11 Control Terminals

Circuit diagram for digital inputs (NPN current 16 mA.)



NOTE
Control signal wiring size: 18 AWG (0.75 mm²) with shielded wire.



6.11.1 Specification of control terminals

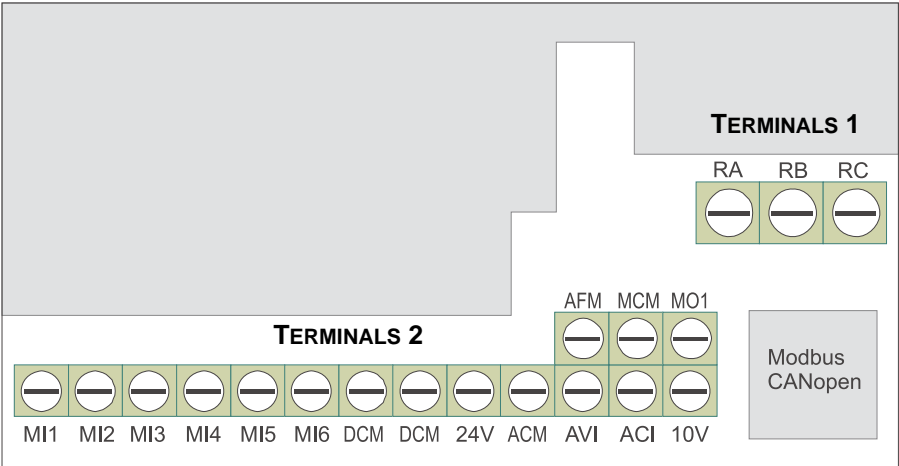


Figure 32: Position of control terminals

| Frame | Control terminals | Torque | Wire |
|---------|-------------------|--------|-------------------------------------|
| 1, 2, 3 | Terminals 1 | 0.5 Nm | 12-24 AWG (3.3-0.2mm ²) |
| | Terminals 2 | 0.2 Nm | 16-24 AWG (1.3-0.2mm ²) |

6.11.2 Terminal symbols and functions

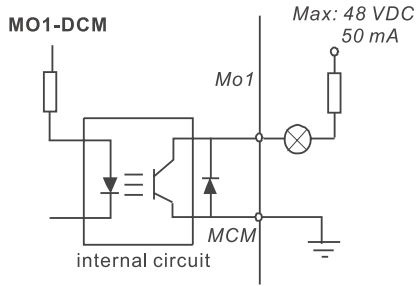
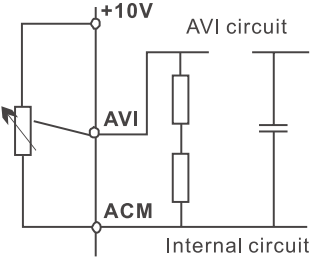
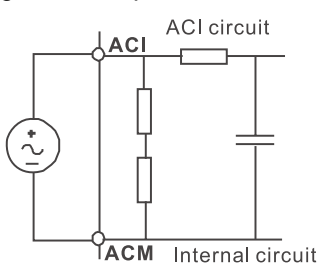
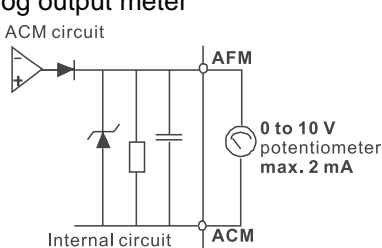
| Terminal symbol | Terminal function | Factory settings (NPN mode) ON: connect to DCM |
|-----------------|---|---|
| MI1 | Forward-Stop command | ON: Run in MI1 direction OFF: Stop according to stop method |
| MI2 | Reverse-Stop command | ON: Run in MI2 direction OFF: Stop according to stop method |
| MI3 | Multi-function input 3 | Refer to P1091 to P1094 for programming the multi-function Inputs. ON: the activation current is 16mA. OFF: leakage current tolerance is 10µA. |
| MI4 | Multi-function input 4 | |
| MI5 | Multi-function input 5 | |
| MI6 | Multi-function input 6 | |
| +24V | DC voltage source | +24V _{DC} , 20 mA used for PNP mode. |
| DCM | Digital signal ground | Ground for digital inputs and used for NPN mode. |
| RA | Multi-function relay output (N.O.) a | Resistive Load: 5A (N.O.) / 3A (N.C.) 240 V _{AC} 5A (N.O.) / 3A (N.C.) 24 V _{DC} Inductive Load: 1.5A (N.O.) / 0.5A (N.C.) 240 V _{AC} 1.5A (N.O.) / 0.5A (N.C.) 24 V _{DC} Refer to P1110 for programming |
| RB | Multi-function relay output (N.C.) b | |
| RC | Multi-function relay ground | |
| MO1 | Multi-function output 1 (photocoupler) | Maximum 48 V _{DC} , 50 mA Refer to P1111 for programming  |
| MCM | Multi-function output ground | Ground for multi-function outputs |
| +10V | Potentiometer power supply | +10V _{DC} 3 mA |
| AVI | Analog voltage input  | Impedance: 47 kΩ Resolution: 10 bits Range: 0 to 10 V _{DC} = 0 to max. output frequency (P0033) Selection: P0801, P0809, P1359 Set-up: P1128 to P1132 |

Figure 34: Analog voltage input

Figure 33: Multi-function output 1

| Terminal symbol | Terminal function | Factory settings (NPN mode) ON: connect to DCM |
|-----------------|--|--|
| ACI | Analog current input  Figure 35: Analog current input | Impedance: 250 Ω Resolution: 10 bits Range: 4 to 20 mA = 0 to max. output frequency (P0033) Selection: P0801, P0809, P1359 Set-up: P1128 to P1132 |
| AFM | Analog output meter  Figure 36: Analog output meter | Impedance: 0 to 10 V, 2 mA 20 k Ω Output current: 2 mA max. Resolution: 8 bits Range: 0 to 10 V _{DC} Function: P1162 and P1163 |
| ACM | Analog control signal (ground) | Ground for AVI, ACI, AFM |

- ☐ Keep control wiring as far away as possible from the power wiring and in separate conduits to avoid interference. If necessary let them cross only at 90° angle.
- ☐ The device control wiring should be properly installed and not touch any live power wiring or terminals.

NOTE



- ☐ If a filter is required for reducing EMI (Electro Magnetic Interference), install it as close as possible to the device. EMI can also be reduced by lowering the carrier frequency.
- ☐ When using a GFCI (Ground Fault Circuit Interrupter), select a current sensor with sensitivity of 200 mA, and not less than 0.1-second detection time to avoid noise tripping.

6.11.3 Analog input terminals (AVI, ACI, ACM)

- Analog input signals are easily affected by external noise. Use shielded wiring and keep it as short as possible (< 20 m) with proper grounding. If the noise is inductive, connecting the shield to terminal ACM can bring improvement.
- If the analog input signals are affected by noise from the device, please connect a capacitor (0.1 F and above) and ferrite core as indicated in the following diagrams:

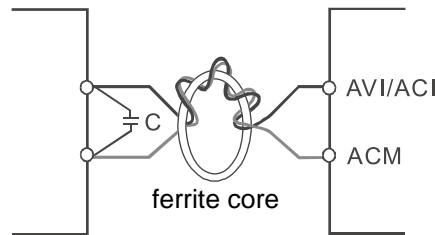


Figure 37: Analog input terminals

NOTE

Wind each wires 3 times or more around the core



6.11.4 Multi-function-inputs (MI1 to MI6, DCM)

- When using contacts or switches to control the digital inputs, please use high quality components to avoid contact bounce.

NOTE

The multi-function inputs MI1 and MI2 are used for operation commands (e.g. STOP, RUN, FWD, REV) only.



6.11.5 Multi-function output (MO1, MCM)

- Make sure to connect the digital outputs to the right polarity, see wiring diagrams.
- When connecting a relay to the digital outputs, connect a surge absorber or flyback diode across the coil and check the polarity.

6.12 External parts

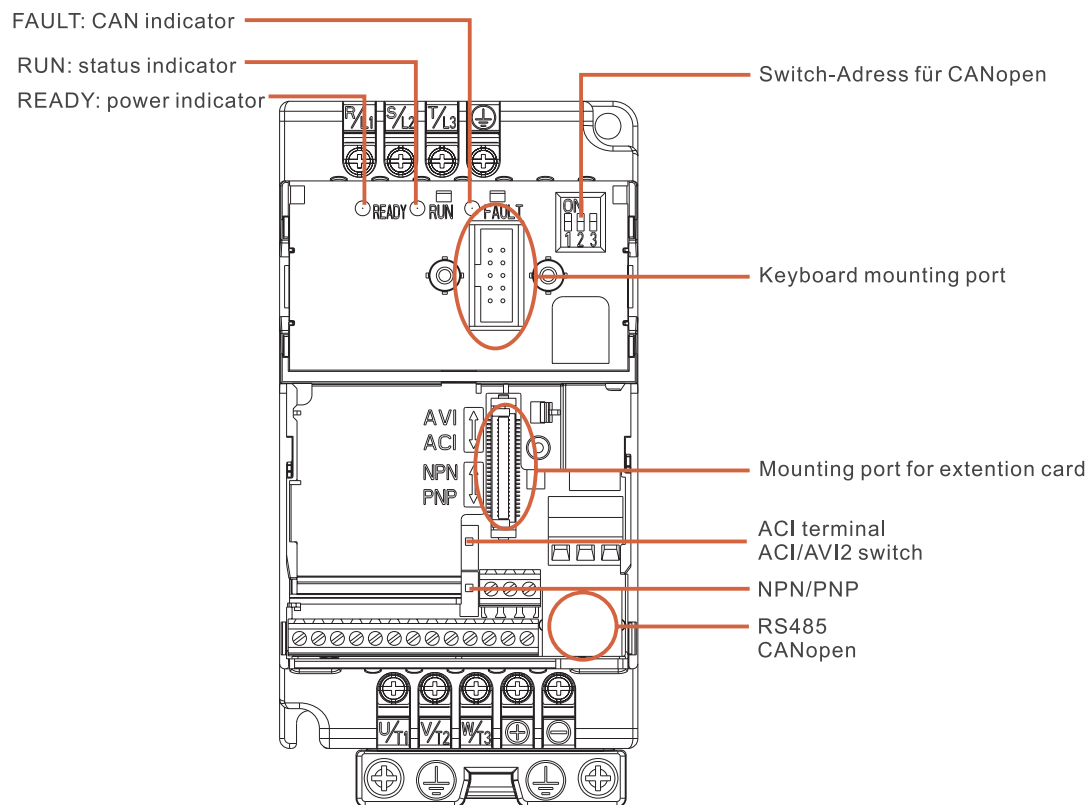


Figure 38: External parts

6.13 RFI jumper

Main power isolated from earth:

If the device is supplied from an isolated power (IT power), the RFI jumper must be cut off. Then the RFI capacities (filter capacitors) will be disconnected from ground to prevent circuit damage (according to IEC 61800-3) and reduce earth leakage current. Refer to the following figures for the position of RFI jumper.



Frame 1
(on the top)



Frame 2
(at the right side)



Frame 3
(at the left side)

WARNING

The following **may occur**, if you disregard these safety notes:

m serious personal injury m death

*The danger is: **electricity**. Parts, which are under tension are perilous.*

- ☐ After applying power to the device, do not cut off the RFI jumper. Therefore, please make sure that main power has been switched off before cutting the RFI jumper.
- ☐ The gap discharge may occur when the transient voltage is higher than 1,000V. Besides, electro-magnetic compatibility of the device will be lower after cutting the RFI jumper.
- ☐ Do NOT cut the RFI jumper when main power is connected to earth.
- ☐ The RFI jumper cannot be cut when high voltage tests are performed. The mains power and motor must be separated if high voltage test is performed and the leakage currents are too high.
- ☐ To prevent drive damage, the RFI jumper connected to ground shall be cut off if the device is installed on an ungrounded power system or a high resistance-grounded (over 30 Ω) power system or a corner grounded TN system.



6.14 Connect the DC link of the devices in parallel

6.14 Connect the DC link of the devices in parallel

- m The devices can absorb mutual voltage that generated to DC link when deceleration
- m Enhance brake function and stabilize the voltage of the DC link
- m The brake module can be added to enhance brake function after connecting in parallel
- m Only the same power system can be connected in parallel
- m It is recommended to connect 5 devices in parallel (no limit in power)

NOTE

Power should be applied at the same time (only the same power system can be connected in parallel)



Power should be applied at the same time
(only the same power system can be connected
in parallel)

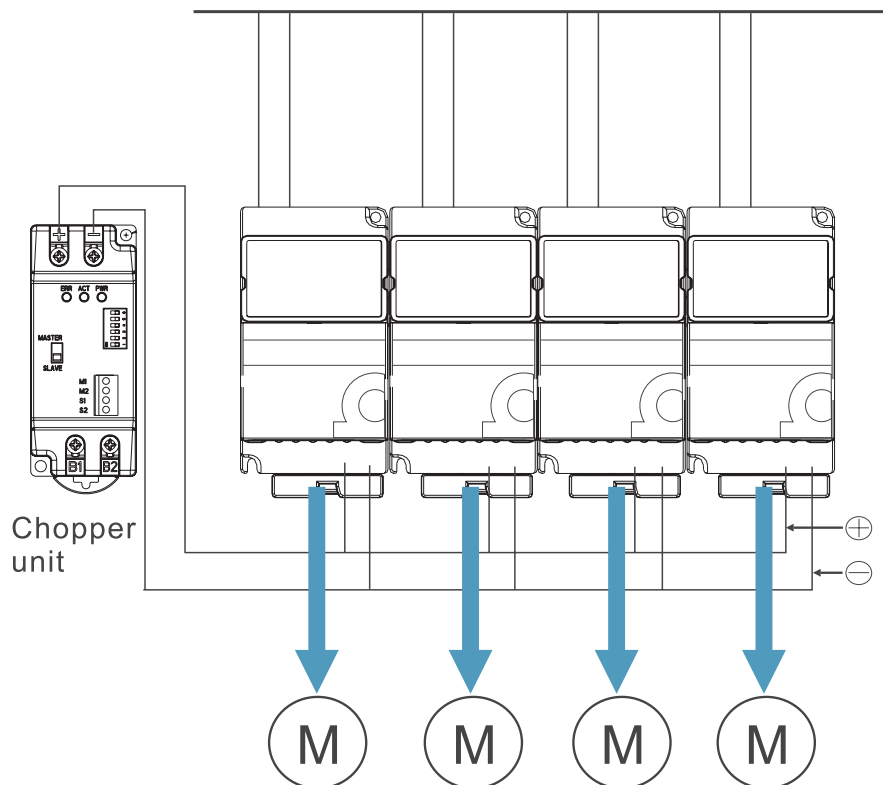


Figure 39: DC link of the devices in parallel

6.15 Applications for mains chokes

Connected in input circuit

| Application 1 | Question |
|---|--|
| When more than one device is connected to the same mains power, and one of them is ON during operation. | When applying power to one of the devices, the charge current of the capacitors may cause voltage dip. The device may be damaged when overcurrent occurs during operation. |

Correct wiring

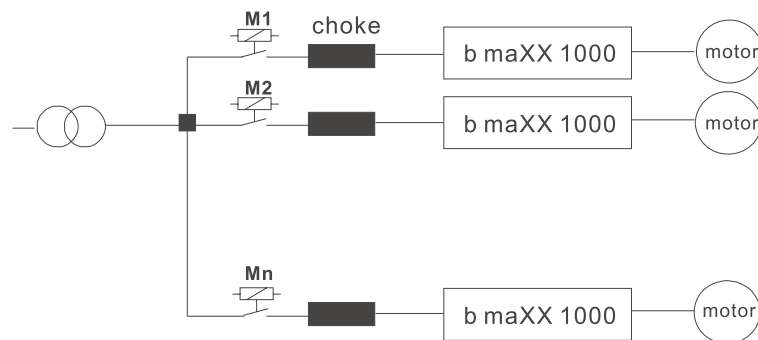


Figure 40: Application 1 mains choke

| Application 2 | Question |
|---|---|
| Silicon rectifier and device are connected to the same power. | Switching spikes will be generated when the silicon rectifier switches on/off. These spikes may damage the mains circuit. |

Correct wiring

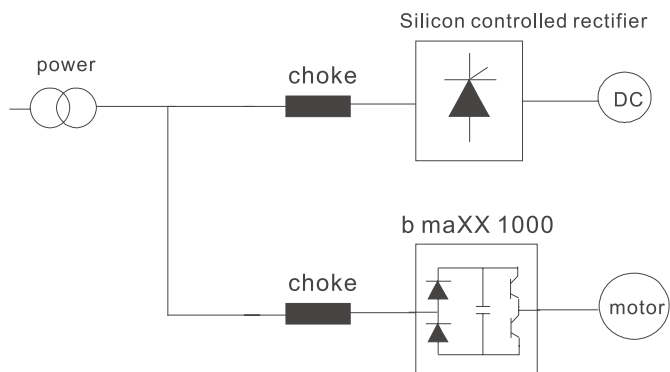


Figure 41: Application 2 mains choke

| Application 3 | Question |
|---|--|
| Used to improve the input power factor, to reduce harmonics and provide protection from AC line disturbances (surges, switching spikes, short interruptions, etc.). The chokes should be installed when the power supply capacity is 500 kVA or more and exceeds 6 times the inverter capacity, or the mains wiring distance ≤ 10 m. | When the mains power capacity is too large, line impedance will be small and the charge current will be too high. This may damage b maXX® BM1000 drive due to higher rectifier temperature. |

Correct wiring

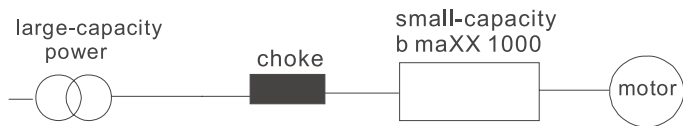


Figure 42: Application 3 mains choke

OPERATION

In this chapter we describe, how the device works during operation and how you handle the device during operation.

7.1 Safety instructions

h Refer to the safety instructions from the chapter [ZFundamental safety instructions](#)— from page 11.



CAUTION

The following **may occur**, if you disregard these safety notes:

m Property damage

*The danger is: **Environmental conditions, that do not refer to the demands.***

Assure, that the environmental conditions are referred to during operation (see [ZD.1 Required environmental conditions](#)— on page 142).



WARNING

The following **may occur**, if you disregard these safety notes:

m serious personal injury m death

*The danger is: **electricity.** The control cabinet, in which the device is built in, shall protect against contacts with parts, which are under voltage.*

Assure, that during operation all doors of the control cabinet are closed.

Assure, that during operation all safety devices work.

7.2 Requirements to the executing personnel

7.2 Requirements to the executing personnel



WARNING

The following **may occur**, if you disregard these safety notes:

m serious personal injury m death

*The danger is: **electricity**. When operating with this electrical unit, inevitably certain parts of this unit are under dangerous voltage.*

Assure, that only qualified personnel work on this unit.

At each case qualified personnel are persons, who are authorized by the responsible persons, to execute necessary actions and who recognize the possible dangers and who are able to avoid these dangers. They have had the training, the experience, they were given instructions as well as knowledge about the relevant standards and instructions, they have knowledge of the accident prevention regulations and of the operating environments. The required qualifications for the work with this unit are for example:

- m Education or instruction or to have the authorization to put into operation, ground and label circuits and devices according to the standards of safety engineering.
- m Training or instruction due to the standards of the safety engineering in maintenance and use of appropriate safety equipment.

7.3 LEDs

There are three LEDs on the front of the **b maXX[®]** when using no optional digital keypad:



H1: READY

It will light up after applying power.

The light won't be off until the capacitors are discharged to safe voltage levels after power off.

H2: **b maXX[®]** drive status

It will light up green, when the drive is in status operation enabled.

It will light up red, when the drive is in error status.

H3: CANopen status

It will light up green, when the CANopen is in operation.

It will light up red, when CANopen is in status bus off.








7.4 Digital keypad (option)



Figure 43: Digital keypad

| Display Message | Description |
|-----------------|---|
| | Displays the master frequency. |
| | Displays the actual output frequency at terminals U/T1, V/T2, and W/T3. |
| | User defined unit (where $U = F \times P0038$) |
| | Displays the output current at terminals U/T1, V/T2, and W/T3. |
| | Displays the forward run status. |
| | Displays the reverse run status. |
| | The counter value (C). |
| | Displays the selected parameter. |

7.4 Digital keypad (option)

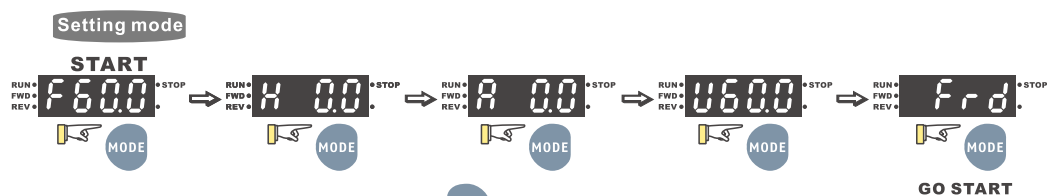
| Display Message | Description |
|---|--|
|  | Displays the actual stored value of the selected parameter. |
|  | External Fault. |
|  | Display „End“ for approximately 1 second if input has been accepted by pressing  key. After a parameter value has been set, the new value is automatically stored in memory. To modify an entry, use the  and  keys. |
|  | Display „Err“, if the input is invalid. |

NOTE

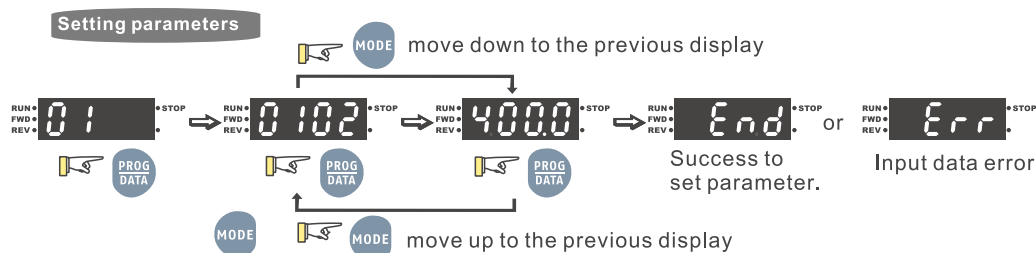


When the setting exceeds 99.99 for those numbers with 2 decimals (i.e. unit is 0.01), it will only display 1 decimal due to 4-digital display.

m How to operate the digital keypad



NOTE In the selection mode, press to set the parameters.



NOTE In the parameter setting mode, you can press to return the selecting mode.



Figure 44: Keypad operation

7.5 Preparations before commissioning

Carefully check the following items before proceeding.

- ☐ Make sure that the wiring is correct. In particular, check that the output terminals U/T1, V/T2, W/T3 are NOT connected to power and that the drive is well grounded.
- ☐ Verify that there are no short-circuits between terminals and from terminals to ground or mains power.
- ☐ Check for loose terminals, connectors or screws.
- ☐ Verify that no other equipment is connected to the motor.
- ☐ Make sure that all switches are OFF before applying power to ensure that the device doesn't start running and there is no abnormal operation after applying power.
- ☐ Make sure that the front cover is correctly installed before applying power.
- ☐ Do NOT operate the device with humid hands.
- ☐ Check the following items after applying power: The display without digital keypad should be as follows.



When power is applied. LED „H1“ should light up

Figure 45: Device ready without digital keypad

- ☐ The display with digital keypad should light up as follows (normal status with no error)



When power is ON, it will be displayed „F0.0“ and LED „STOP“ and „FWD“ should light up

Figure 46: Device ready digital keypad

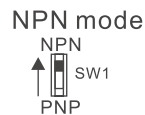
NOTE



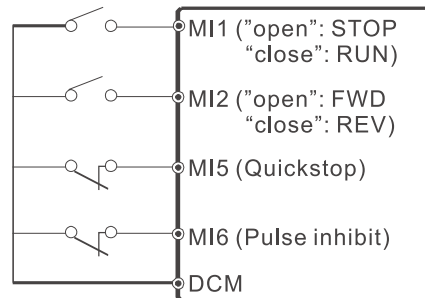
If the drive has a built-in fan, it should run. The factory setting of Fan control **P0024** = 0 (fan always on).

7.6 Commissioning example

| | | |
|------------------------|---------------------------|-------------------------------|
| Required functionality | m Source of first command | from multi-function input MI1 |
| | RUN / STOP | |
| | FWD (forward running) | from multi-function input MI2 |
| | REV (reverse running) | |



RUN / STOP
FWD / REV
QUICKSTOP
PULSE INHIBIT



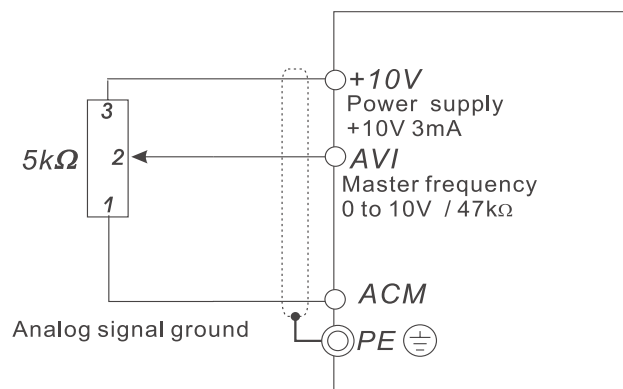
Additional STOP

from digital keypad



m First master frequency

from analog voltage input AVI



7.6 Commissioning example

Required parameter settings

Operation of keypad see [ZDigital keypad \(option\)](#)– from page 73.

| | | | |
|--|--------------|---|---|
| Reset parameter to factory setting | P0310 | ⇒ | 9 |
| Source of first operation command | P0802 | ⇒ | 1 |
| RUN/STOP from multi-function input MI1 | | | |
| FWD/REV from multi-function input MI2 | P1090 | ⇒ | 1 |
| Source of first master frequency | P0801 | ⇒ | 1 |

Execute the auto-tuning function

The autotuning function sequence is necessary for a correct operation of the motor!
The autotuning function must be executed without motor load.



NOTE

- m Stop running immediately if any fault occurs and refer to the troubleshooting guide for solving the problem.
- m Do NOT touch output terminals R/L1, S/L2, T/L3 when power is still applied to U/T1, V/T2, W/T3 even when the device has stopped. The DC-link capacitors may still be charged to hazardous voltage levels, even if the power has been turned off.
- m To avoid damage to components, do not touch them or the circuit boards with metal objects or your bare hands.



CAUTION

The motor will rotate!

| | | | |
|--|--------------|---|-----|
| Operation mode set value | P1000 | ⇒ | 249 |
| Autotuning with running motor (without load) | P0850 | ⇒ | 2 |

After finishing autotuning function parameter **P0850** is set to 0.

The autotuning function is completed when LED **RUN** is OFF and LED **STOP** is ON.



Operation mode set value
(speed setting 1)

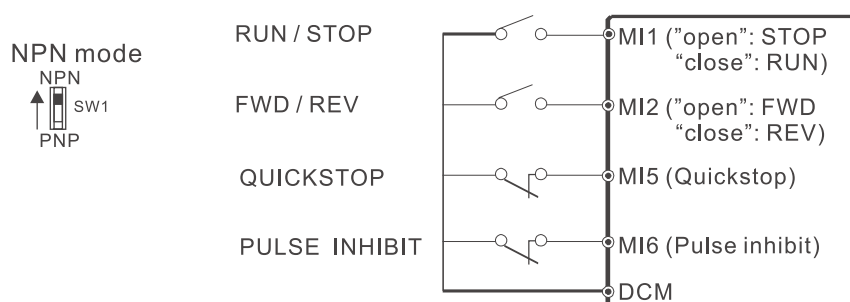
P1000



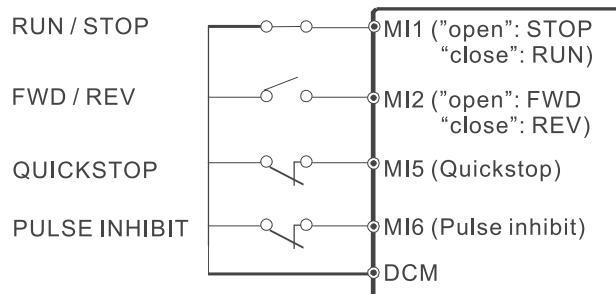
2

START from multi-function input MI1

1st step (close Quickstop)



2nd step (close RUN/STOP)




LED RUN = ON



LED STOP = OFF



Test of functionality

- ☐ START from multi-function input MI1
 - ☐ LED **RUN** or **H1** = ON
 - ☐ LED **STOP** or **H2** = OFF
- ☐ Control the motor speed from analog voltage input AVI1.
- ☐ Control the motor speed direction from multi-function input MI2.
- ☐ And if you want to decelerate to stop, please press  key.

7.7 Maintenance

Maintenance is first of all the monitoring of the environmental conditions. With accordant projection of your installation you can execute the monitoring of the environmental conditions in the running operation and don't have to interrupt the operation for the maintenance.

Additional data is available in [ZMaintenance](#)— from page 101.

ERROR DETECTION AND TROUBLE-SHOOTING

In this chapter the error messages of the device are described: Error- and warning messages, their meanings and how you can react.

8.1 Safety instructions

h Refer to [ZFundamental safety instructions](#)— from page 11.

8.2 Requirements to the executing personnel

The personnel, who works with the **b maXX®** device, must be introduced in the safety instructions and in the operation of the device and must be familiar with the accurate operating of the device. Especially the reaction to failure indications and -conditions requires special knowledge, which the operator must have.

8.3 Error information

The **b maxx® 1000** has a comprehensive fault diagnostic system that includes several different alarms and fault messages. Once a fault is detected, the corresponding protective functions will be activated. The following faults are displayed as shown on the device digital keypad display. The five most recent faults can be read from the digital keypad or communication.

NOTE



Wait 5 seconds after a fault has been cleared before performing reset via keypad of input terminal.

8.3 Error information

8.3.1 Fault code information

| Fault code | Fault name | Fault description | Error reaction | Corrective actions |
|---------------------|------------------------------------|---|----------------|--|
| 0003 _{hex} | oc | Over current Abnormal increase in current. | PWM inhibit | <ul style="list-style-type: none"> m Check if motor power corresponds with the device output power. m Check the wiring connections to U/T1, V/T2, W/T3 for possible short circuits. m Check the wiring connections between the device and motor for possible short circuits, also to ground. m Check for loose contacts between device and motor. m Increase the acceleration time. m Check for possible excessive loading conditions at the motor. m If there are still any abnormal conditions when operating the device after a short-circuit is removed and the other points above are checked, it should be sent back to manufacturer. |
| 0021 _{hex} | cPtE cc02 cc04 to cc08 | CAN error | P0296 | <ul style="list-style-type: none"> m cPtE: initialization error m cc02: Node Guarding or Heartbeat error m cc04: no CAN communication between slave and master m cc05: hardware failure or no CANopen hardware available on processing unit m cc06: no CANopen software available on processing unit m cc07: an update of CANopen is necessary m cc08: hardware error |
| 0030 _{hex} | AnCd | Error in analog option card | P1007 | <ul style="list-style-type: none"> m Check or change analog option card |
| 0035 _{hex} | AoFF | Analog option card break off error | PWM inhibit | <ul style="list-style-type: none"> m Check or change analog option card |
| 0050 _{hex} | UbCd PE10 | Communication error USB (CME-USB-01) or IO COM1 communication time out | P0868 | <ul style="list-style-type: none"> m Check or change analog option card |

| Fault code | Fault name | Fault description | Error reaction | Corrective actions |
|---------------------|------------|--|----------------|---|
| 0052 _{hex} | ov | Over voltage The DC link voltage has exceeded its maximum allowable value. | PWM inhibit | <ul style="list-style-type: none"> m Check if the input voltage falls within the rated device input voltage range. m Check for possible voltage transients. m DC link over-voltage may also be caused by motor regeneration. Either increase the deceleration time or add an optional braking resistor (and brake unit). m Check whether the required braking power is within the specified limits. |
| 0054 _{hex} | GFF | Ground fault | PWM inhibit | <p>When (one of) the output terminal(s) is grounded, short circuit current is more than 50 % of b maXX[®] rated current, the drive power module may be damaged.</p> <p>NOTE: The short circuit protection is provided for b maXX[®] drive protection, not for protection of the user.</p> <ul style="list-style-type: none"> m Check whether the IGBT power module is damaged. m Check for possible poor insulation at the output line. |
| 0062 _{hex} | PtC1 | Motor overheat protection | P0119 | <ul style="list-style-type: none"> m Check if the motor is overheated m Check P0117 to P0122 settings |
| 0063 _{hex} | oL1 | Overload 1 $I_t > 100 \%$ | PWM inhibit | <ul style="list-style-type: none"> m Check for possible motor overload. m Check electronic thermal overload setting. m Use a higher power motor. m Reduce the current level so that the drive output current does not exceed the value set by the Motor rated current P0054. |
| 0070 _{hex} | PGEr | Communication error PG card (option card) | P1077 | <ul style="list-style-type: none"> m Check or change PG option card |
| 00A0 _{hex} | cE10 | Communication error modbus | P0862 | <ul style="list-style-type: none"> m Check the RS485 connection between the b maXX[®] drive and RS485 master for loose wires and wiring to correct pins. m Check if the communication protocol, address, transmission speed, etc. are properly set. m Use the correct checksum calculation. |

8.3 Error information

| Fault code | Fault name | Fault description | Error reaction | Corrective actions |
|---------------------|------------------------------|---|----------------|--|
| 00A1 _{hex} | cP10 | Communication time-out error on the control board or power board | PWM inhibit | <ul style="list-style-type: none"> m Press RESET key to set all parameters to factory setting m Return the b maXX[®] to the factory |
| 00B0 _{hex} | cF10 cF11 cF20 cF21 | EEPROM error | P1007 | <ul style="list-style-type: none"> m cF10,cF11: internal EEPROM can not be programmed (return the b maXX[®] to the factory) m cF20,cF21: internal EEPROM can not be read (set all parameters to factory setting or return the b maXX[®] to the factory) |
| 00B2 _{hex} | Ecnt | Checksum error in EEPROM | PWM inhibit | <ul style="list-style-type: none"> m The parameter (P0077, P0110, P0811, P0812, P0850, P1172, P1173, P1176, P1177, P1180, P1181, P1182, P1183, P1184, P1361, P1362, P1363, P1359) writing to the EEPROM by power off was not completed. |
| 0500 _{hex} | oH1 | IGBT Overheating | PWM inhibit | <ul style="list-style-type: none"> m Ensure that the ambient temperature is within the specified temperature range. m Make sure that the ventilation holes are not obstructed. m Remove any foreign objects from the heatsink and check for possible dirty heat sink fins. m Check the fan and clean it. m Provide enough spacing for adequate ventilation. |
| 0501 _{hex} | Lv | Low voltage The device detects that the DC link voltage has fallen below its minimum value. | P0297 | <ul style="list-style-type: none"> m Check whether the input voltage falls within the device rated input voltage range. m Check for abnormal load in motor. m Check for correct wiring of input power (for 3-phase models) without phase loss. |
| 0502 _{hex} | PHL | Phase loss | PWM inhibit | <ul style="list-style-type: none"> m Check input phase wiring for loose contacts |
| 0503 _{hex} | codE | Password invalid | P1007 | <ul style="list-style-type: none"> m Return the b maXX[®] to the factory |

| Fault code | Fault name | Fault description | Error reaction | Corrective actions |
|---------------------|------------|--|----------------|--|
| 0505 _{hex} | cF34 | Temperature sensor error | PWM inhibit | m Return the b maXX® to the factory |
| 0506 _{hex} | Aerr | Analog signal error | P0806 | m Check the wiring of ACI |
| 0507 _{hex} | oL | Overload The device detects excessive drive output current. NOTE: The device can withstand up to 150 % of the rated current for a maximum of 60 seconds. | PWM inhibit | m Check whether the motor is overloaded. m Reduce torque compensation setting in P0112 . m Use the next higher power model. |
| 0509 _{hex} | oL2 | Overload 2 Motor overload. | P1213 | m Reduce the motor load. m Adjust the over-torque detection setting to an appropriate setting (P1213 to P1215). |
| 050A _{hex} | HPF1 | CC (current clamp) | PWM inhibit | m Return to the factory |
| 050B _{hex} | HPF2 | OV hardware error | PWM inhibit | |
| 050C _{hex} | HPF3 | GFF hardware error | PWM inhibit | |
| 050D _{hex} | HPF4 | OC hardware error | PWM inhibit | |
| 050E _{hex} | cF33 | DC BUS (0 V or Lv) checking error | PWM inhibit | |
| 0512 _{hex} | PtC2 | Motor PTC temperature error | P0122 | m Check if the motor is overheated m Check P0117 to P0122 settings |
| 0513 _{hex} | FbE | PID feedback error | P1368 | m Check parameter settings (P1360) and AVI/ACI wiring. m Check parameter settings (P1381) offset level for PID control. m Check parameter settings (P1382) detection time for PID offset level. m Check parameter settings (P1368) for error or warning |

8.3 Error information

| Fault code | Fault name | Fault description | Error reaction | Corrective actions |
|---------------------|------------|--|----------------|--|
| 0515 _{hex} | cF30 | U-phase error | PWM inhibit | m Return to the factory |
| 0516 _{hex} | cF31 | V-phase error | PWM inhibit | |
| 0517 _{hex} | cF32 | W-phase error | PWM inhibit | |
| 0518 _{hex} | ocA | Overcurrent during acceleration | PWM inhibit | <ul style="list-style-type: none"> m Short-circuit at motor output: Check for possible poor insulation at the output lines. m Torque boost too high: Decrease the torque compensation setting in P0112. m Acceleration time too short: Increase the acceleration time. m Device output power is too small: Replace the device with the next higher power model. |
| 0519 _{hex} | ocd | Overcurrent during deceleration | PWM inhibit | <ul style="list-style-type: none"> m Short-circuit at motor output: Check for possible poor insulation at the output line. m Deceleration time too short: Increase the deceleration time. m Device output power is too small: Replace the device with the next higher power model. |

| Fault code | Fault name | Fault description | Error reaction | Corrective actions |
|---------------------|------------|--|----------------|--|
| 051A _{hex} | ocn | Overcurrent during constant speed operation | PWM inhibit | <ul style="list-style-type: none"> m Short-circuit at motor output: Check for possible poor insulation at the output line. m Sudden increase in motor loading: Check for possible motor stall. m Device output power is too small: Replace the device with the next higher power model. |
| 051B _{hex} | oH2 | Power board overheat | PWM inhibit | <ul style="list-style-type: none"> m Ensure that the ambient temperature is within the specified temperature range. m Make sure that the ventilation holes are not obstructed. m Remove any foreign objects from the heatsink and check for possible dirty heat sink fins. m Check the fan and clean it. |
| 051C _{hex} | EF | External fault | P0803 | <ul style="list-style-type: none"> m When multi-function input terminals (MI3-MI5 or MI7 to MI12) are set to external fault, the device stops output U/T1, V/T2 and W/T3. m Give RESET command after fault has been cleared. |

NOTE

CANopen error table see [ZE.6.2 CANopen error display via digital keypad](#)— on page 157 and error table in **b maXX[®] 4400** parameter manual.


8.4 Warning code information

8.4 Warning code information

| Warning code | Warning name | Warning descriptions | Parameter |
|--------------|--------------|---|----------------|
| 7 | cE10 | Warning: communication modbus | P0862 |
| 8 | oL2 | Warning: motor load exceeded | P1213 |
| 9 | AUE | Warning: auto tuning error | - |
| 10 | Uc | Warning: under voltage | - |
| 11 | SE1 | Warning: keypad copy parameter operation error | - |
| 12 | SE2 | Warning: keypad copy parameter save error | - |
| 13 | PtC2 | Warning: motor PTC temperature exceeded | P1012 |
| 14 | PGEr | Warning: PG (encoder) loss | P1077 |
| 15 | FbE | Warning: PID feedback | P1368 |
| 16 | SAvE | Warning: keypad copying | - |
| 23 | PE10 | Warning: IO COM1 communication time out | P0868 |
| 25 | Lv | Warning: DC BUS voltage has lower than standard voltage | P0297 |
| 26 | Aerr | Warning: control board ACI (current) loss | P0806 |
| 27 | bb | Warning: base block | P1091 to P1100 |
| 33 | CSdo | Warning: CANopen SDO time out | |
| 34 | CSfF | Warning: CANopen buffer overflow | |
| 36 | CbtU | Warning: CANopen boot up error | |
| 50 | cc01 | Warning: At least one of the error counters of the CANopen slave has reached the value 96 | |
| 51 | cc03 | Warning : The SYNC-message is not received within the configured time | |
| 52 | UbCd | Warning: communication error USB card | P0868 |
| 53 | cPt2 | Warning: CAN error | |

8.5 Reset

There are three methods to reset the device after solving the fault:

- m Press  key on keypad.
- m Set external terminal to „RESET“ (set one of **P1091** to **P1094** to 05) and then set to be ON.
- m Send „RESET“ command by communication.

NOTE



Make sure that RUN command or signal is OFF before executing RESET to prevent damage or personal injury due to immediate operation.

8.6 Troubleshooting

8.6.1 Overcurrent (OC)

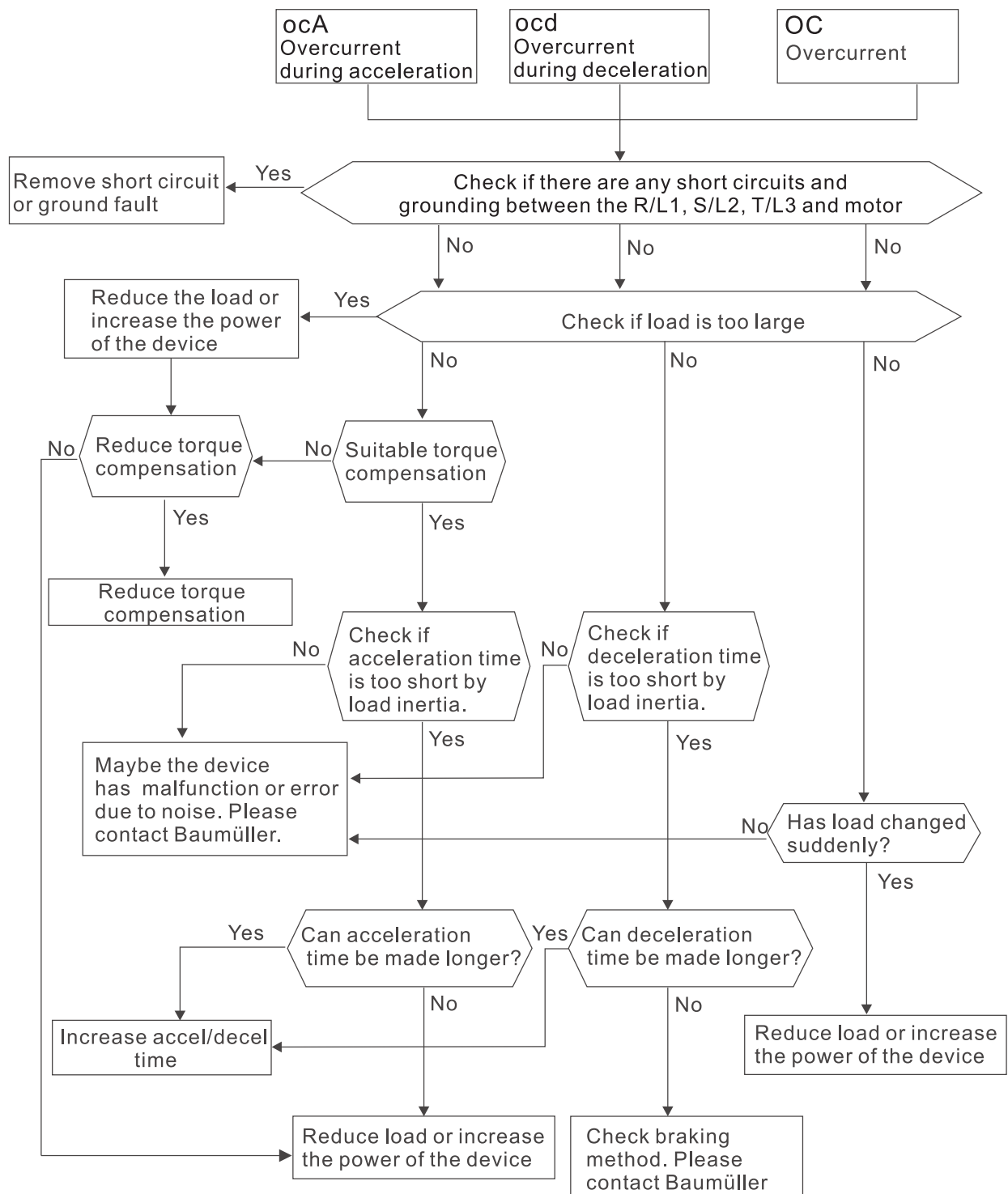


Figure 47: Troubleshooting over current

8.6.2 Ground fault

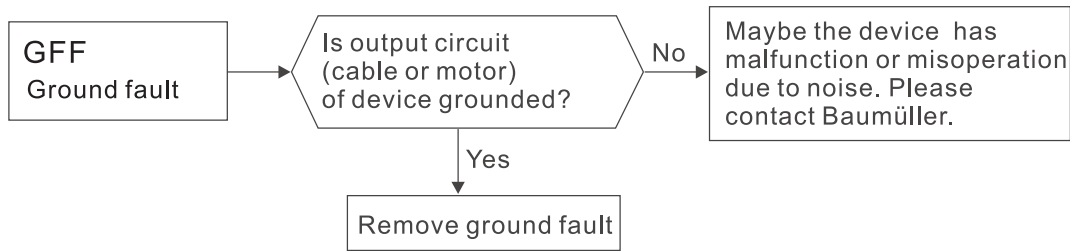


Figure 48: Troubleshooting ground fault

8.6.3 Overvoltage

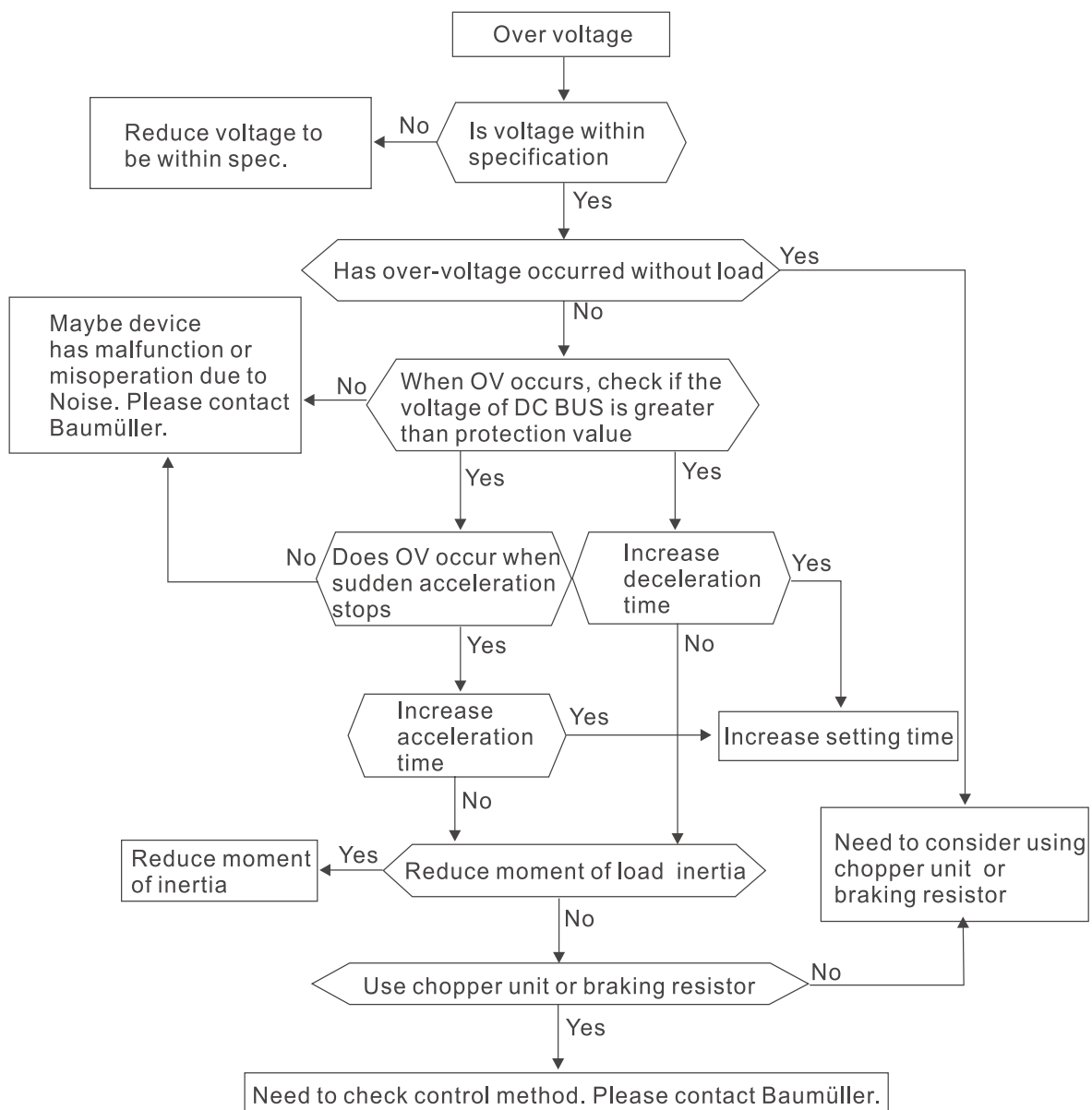


Figure 49: Troubleshooting overvoltage

8.6.4 Low voltage (Lv)

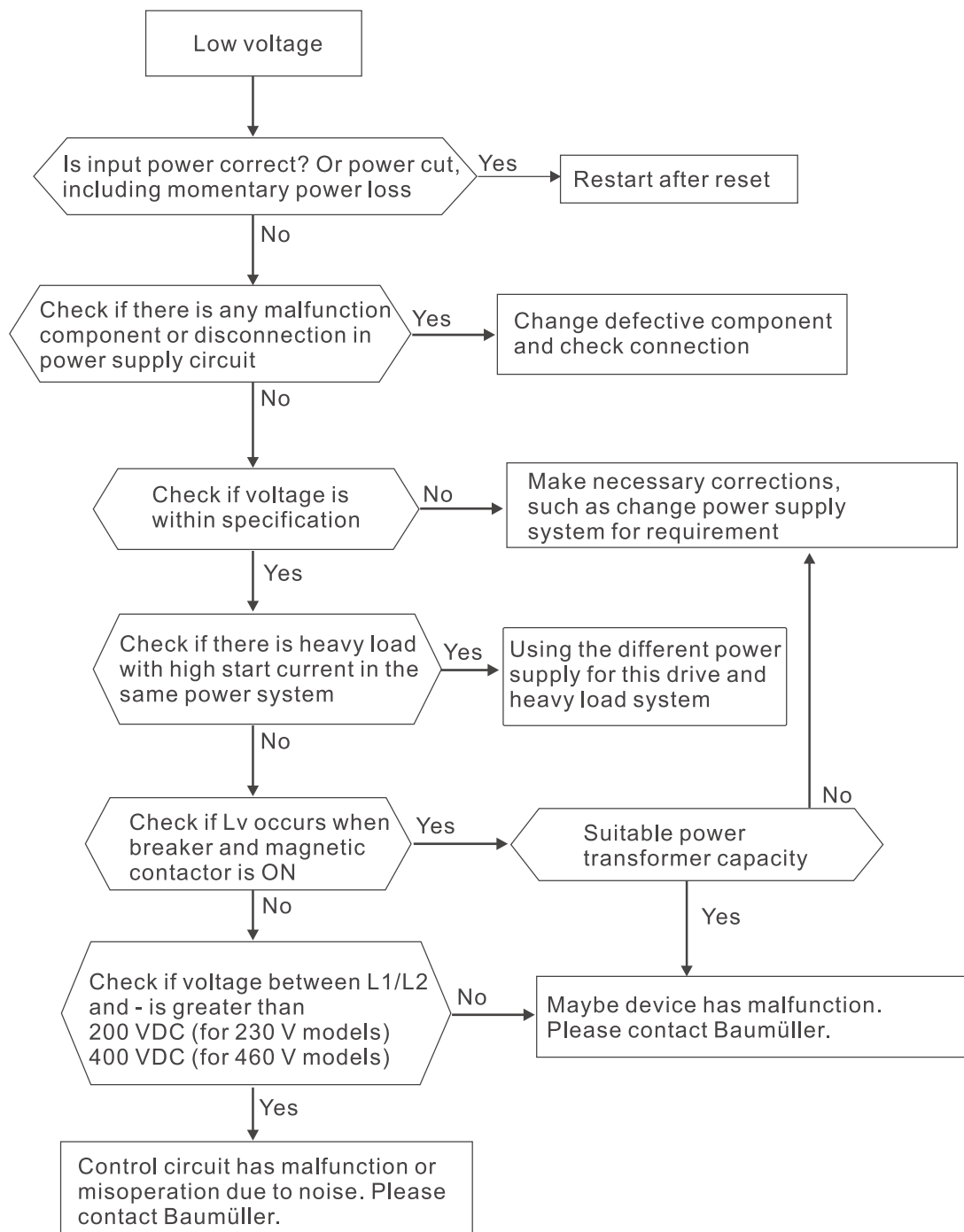


Figure 50: Troubleshooting low voltage

8.6.5 Overheat (OH)

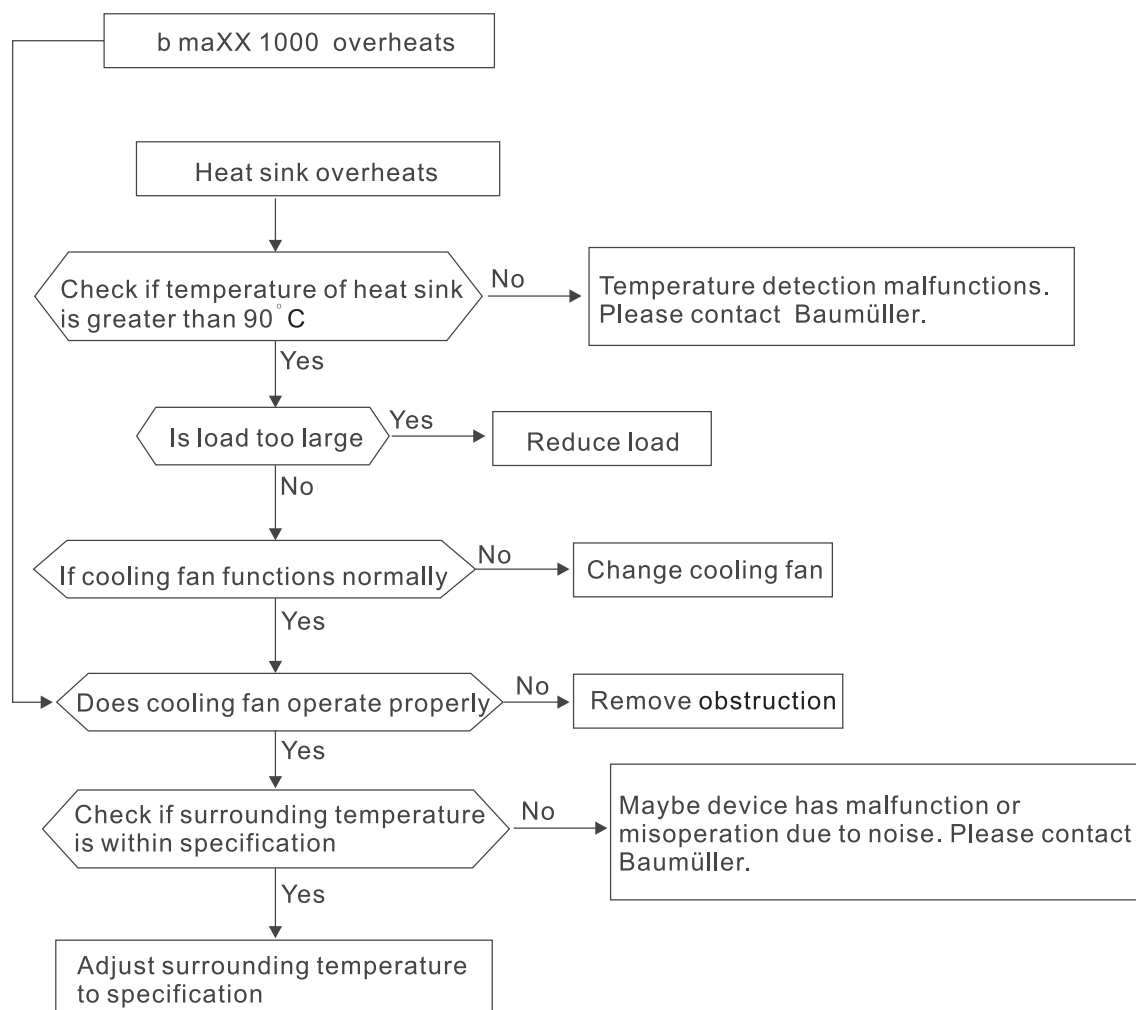


Figure 51: Troubleshooting overheat

8.6.6 Overload OL

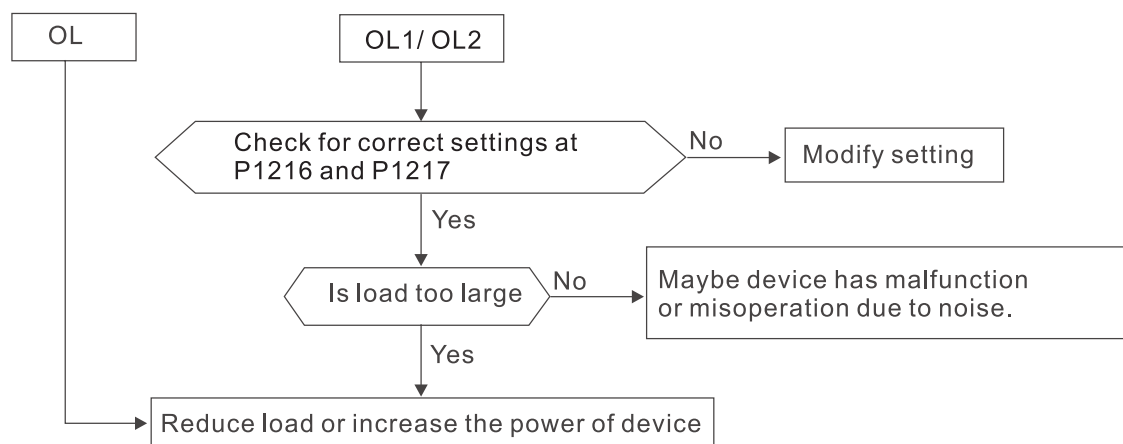


Figure 52: Troubleshooting overload

8.6.7 Keypad display is abnormal

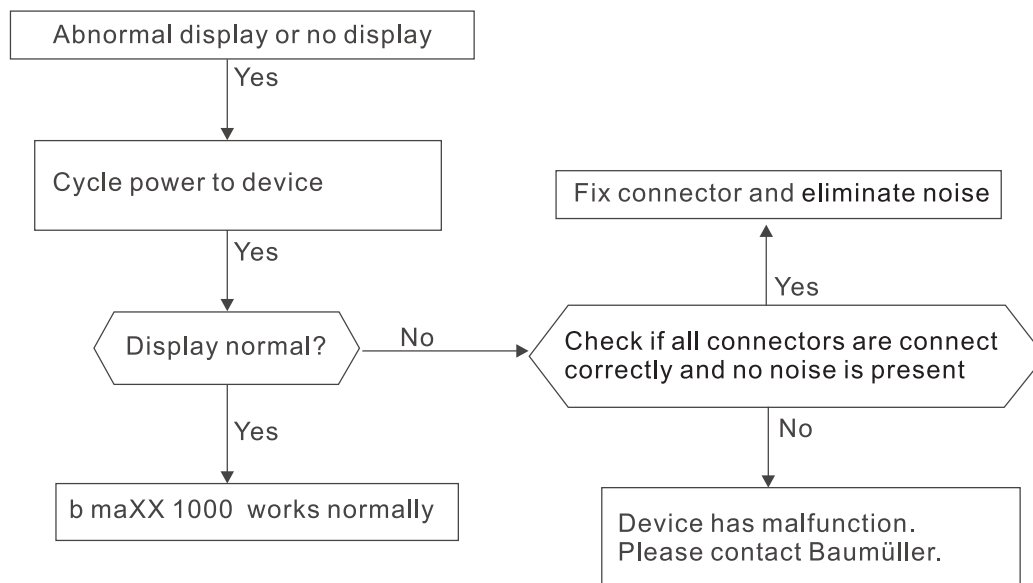


Figure 53: Troubleshooting keypad display

8.6.8 Phase Loss (PHL)

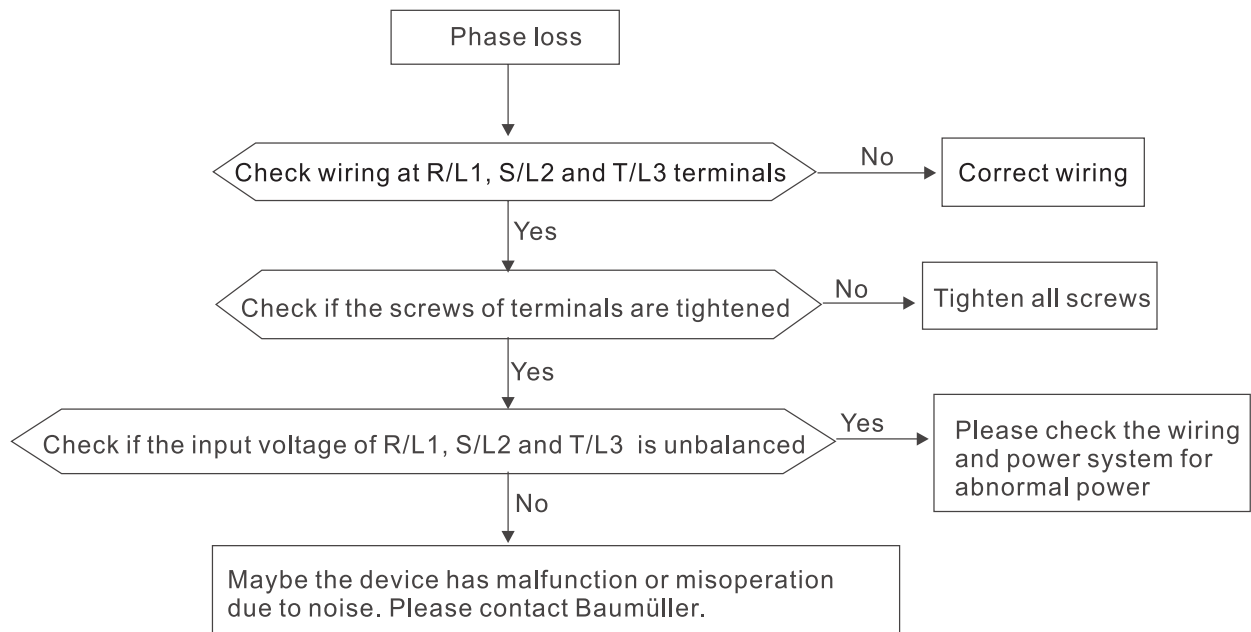


Figure 54: Troubleshooting phase loss

8.6.9 Motor doesn't run

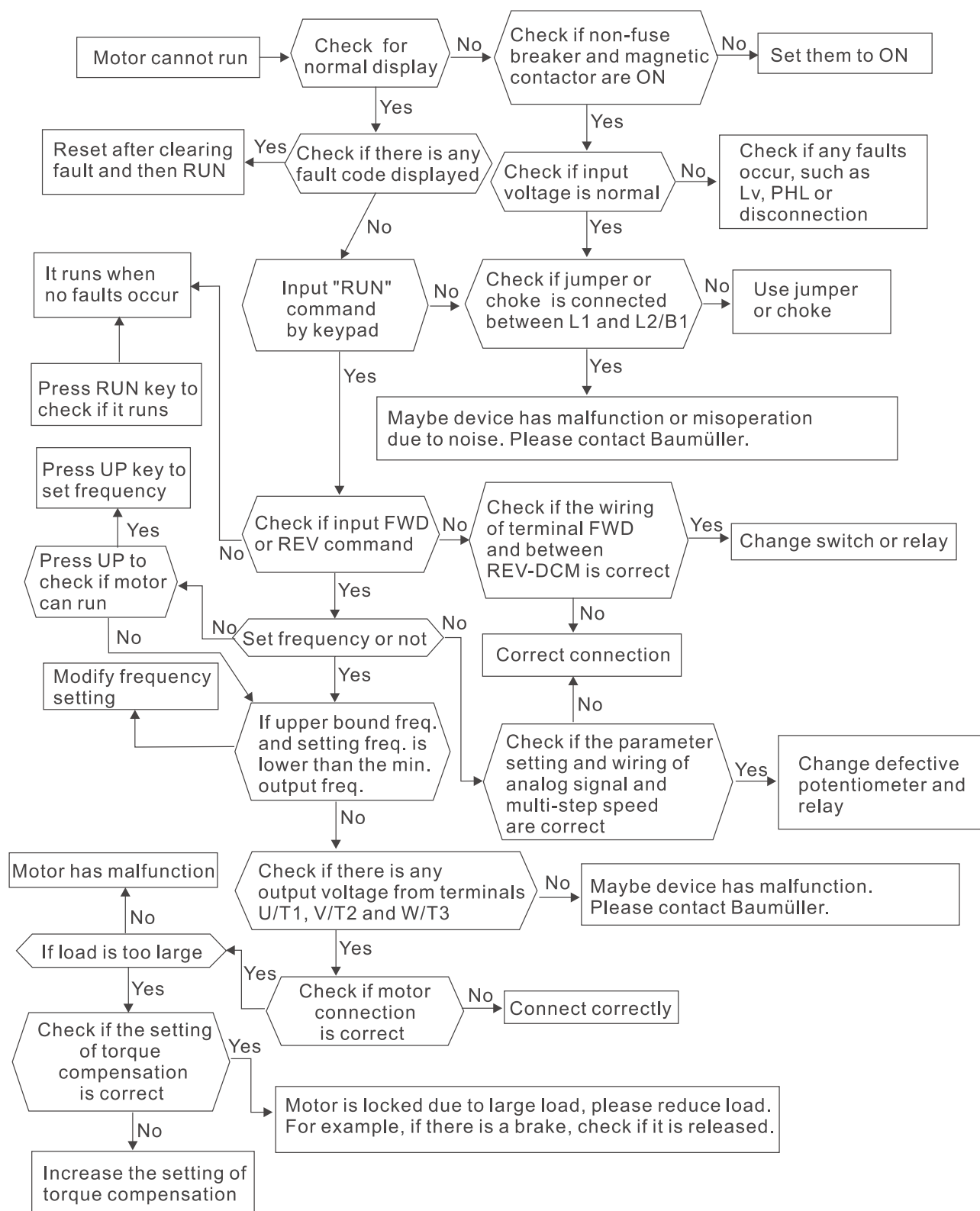


Figure 55: Troubleshooting motor doesn't run

8.6.10 Motor speed cannot be changed

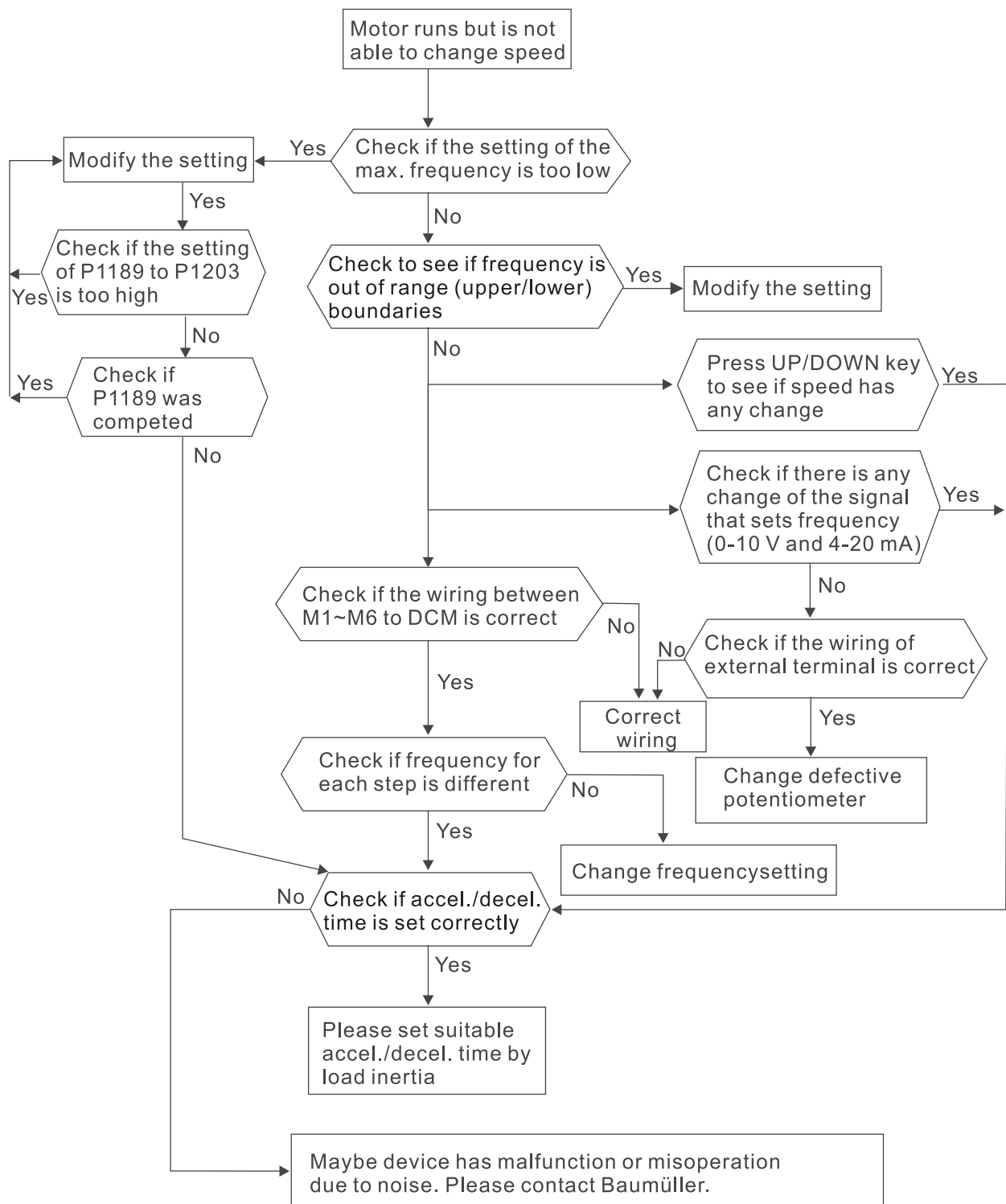


Figure 56: Troubleshooting motor speed cannot be changed

8.6.11 Motor stalls during acceleration

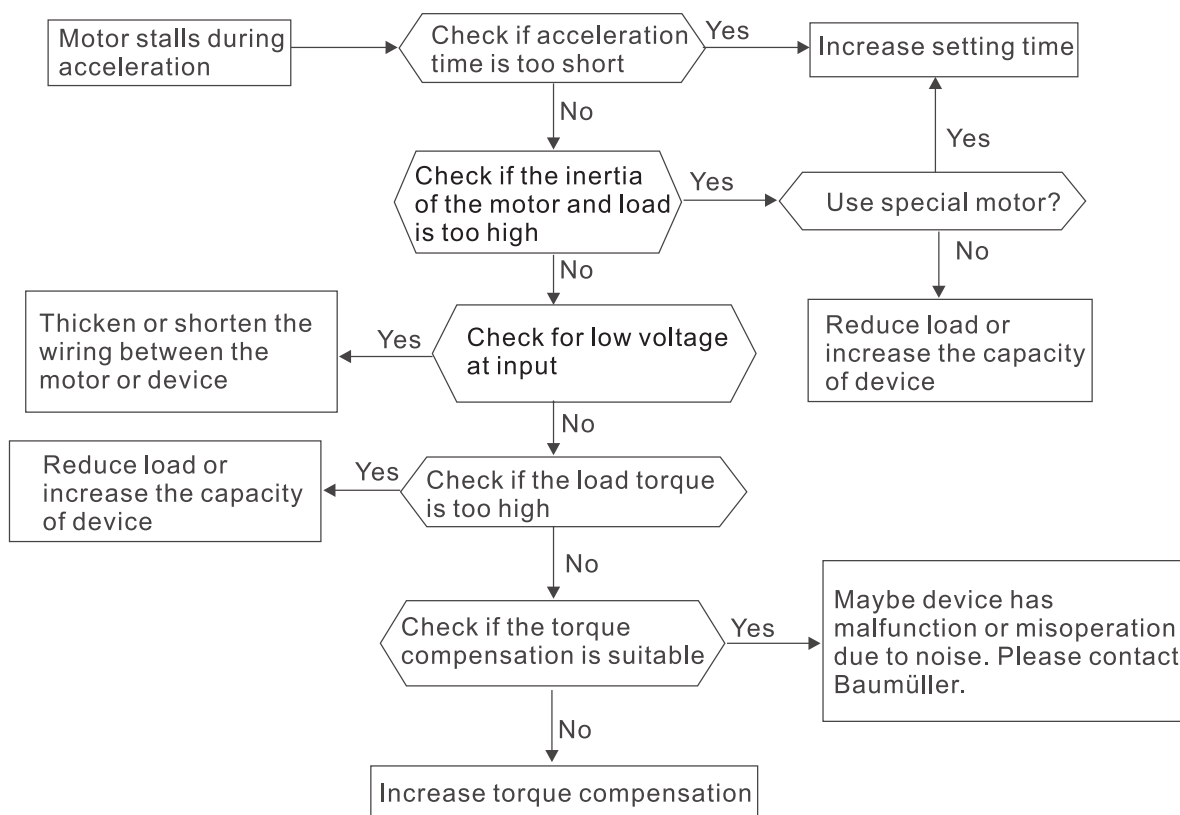


Figure 57: Troubleshooting motor stalls during acceleration

8.6.12 The motor does not run as expected

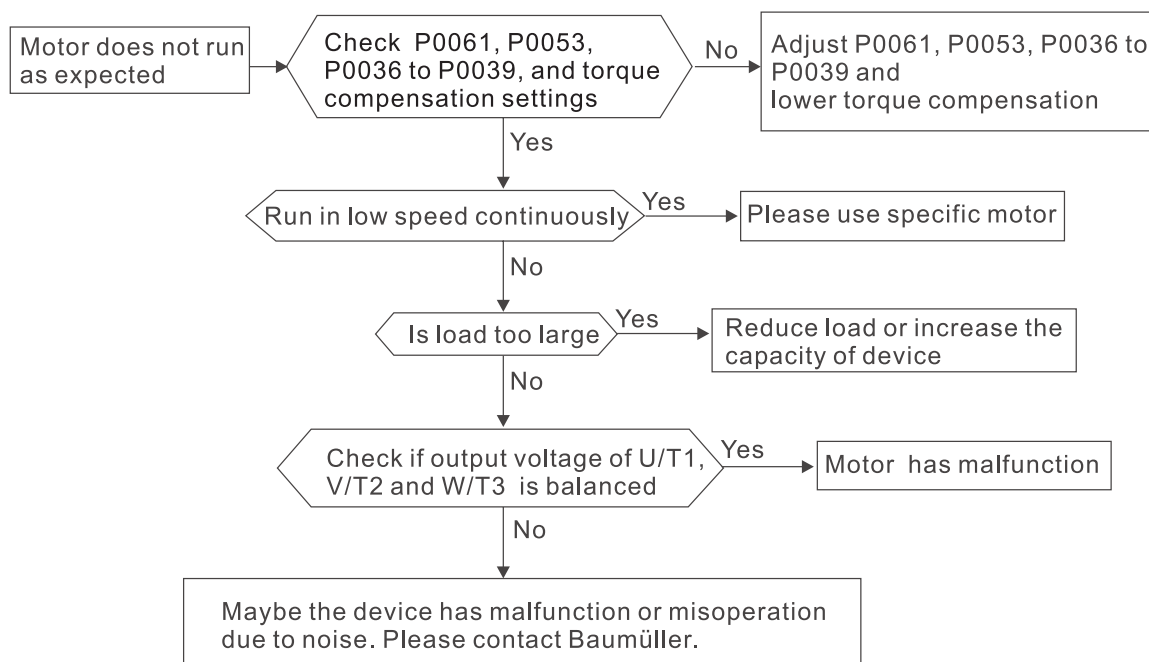


Figure 58: Troubleshooting motor does not run as expected

8.7 Electromagnetic/induction noise

Many sources of noise surround the device and penetrate it by radiation or conduction. It may cause malfunctioning of the control circuits and even damage the device. Of course, there are solutions to increase the noise tolerance of the device. But this has its limits. Therefore it will be the best to solve it from the outside as follows.

- m Add surge suppressor on the relays and contacts to suppress switching surges.
- m Shorten the wiring length of the control circuit or serial communication and keep them separated from the power circuit wiring.
- m Comply with the wiring regulations by using shielded wires and isolation amplifiers for long length.
- m The grounding terminal should comply with the local regulations and be grounded independently, i.e. not to have common ground with electric welding machines and other power equipment.
- m Connect a noise filter at the mains input terminal of the device to filter noise from the power circuit. **b maXX® 1000** can have a built-in filter as option.

In short, solutions for electromagnetic noise exist of „no product“ (disconnect disturbing equipment), „no spread“ (limit emission for disturbing equipment) and „no receive“ (enhance immunity).

8.8 Environmental condition

Since the **b maXX® 1000** is an electronic device, you should comply with the environmental conditions as stated in [ZD.1 Required environmental conditions](#)— from page 142. Here are some remedial measures if necessary.

- m To prevent vibration, the use of anti-vibration dampers is the last choice. Vibrations must be within the specification. Vibration causes mechanical stress and it should not occur frequently, continuously or repeatedly to prevent damage to the device.
- m Store the device in a clean and dry location, free from corrosive fumes/dust to prevent corrosion and poor contacts. Poor insulation in a humid location can cause short-circuits. If necessary, install the device in a dust-proof and painted enclosure and in particular situations, use a completely sealed enclosure.
- m The ambient temperature should be within the specification. Too high or too low temperature will affect the lifetime and reliability. For semiconductor components, damage will occur once any specification is out of range. Therefore, it is necessary to periodically check air quality and the cooling fan and provide extra cooling of necessary. In addition, the microcomputer may not work in extremely low temperatures, making cabinet heating necessary.
- m Store within a relative humidity range of 0 % to 90 % and non-condensing environment. Use an air conditioner and/or exsiccator.

8.9 Affecting other machines

A **b maXX® 1000** may affect the operation of other machines due to many reasons. Some solutions are:

□ High harmonics at power side

- n High harmonics at power side during running can be improved by
 - m Separate the power system: Use a transformer for the device.
 - m Use a choke or rectifier at the power input terminal of the device or decrease high harmonic by multiple circuit.
 - m If phase lead capacitors are used (never on the device output), use chokes to prevent damage to the capacitors from high harmonics.

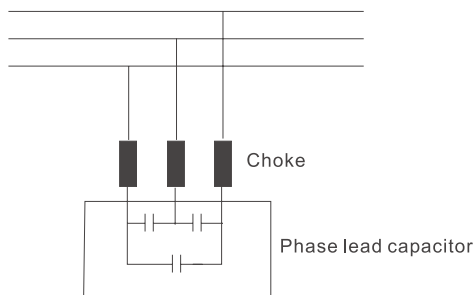


Figure 59: Phase lead capacitors

□ Motor temperature rises

- n When the motor is a standard motor with fan, the cooling will be bad at low speeds, causing the motor to overheat. Besides, high harmonics at the output increases copper and core losses. The following measures should be used depending on load and operation range.
 - m Use a motor with independent ventilation (forced external cooling) or increase the motor rated power.
 - m Use a special inverter-duty motor.
 - m Do NOT run at low speeds for long time.

MAINTENANCE

In this chapter we describe, how you can safely maintain your device.

9.1 Safety instructions

- h Refer to [ZFundamental safety instructions](#)— from page 11.
- h Refer to the danger areas of the devices.



Figure 60: Danger areas b maXX® BM1000

9.2 Environmental conditions

If the prescribed environmental conditions are complied with, the device is maintenance-free. The prescribed environmental conditions are to be found in chapter [ZAppendix D - Technical data](#)— from page 141. The most important prescribed environmental conditions are:

- m Dustless ambient air
- m Temperature: min. -10 °C to max. +50 °C (14 - 122 °F)
min. -10 °C to max +40 °C (14 - 104 °F)
for side-by-side mounting
- m Relative air humidity: 0 to 90 %, no condensation allowed
- m (Operational-) height: Altitude up to 1000 m
- m Atmosphere pressure: 86 - 106 kPa
- m Vibration: <20 Hz: 9.80 m/s² (1 G) max.
20 - 50 Hz: 5.88 m/s² (0.6 G)

9.3 Inspection intervals - maintenance notes

b maXX® 1000 drives are based on solid-state electronics technology. Preventive maintenance is required to keep the device in its optimal condition, and to ensure a long life. It is recommended to have a qualified technician perform a check-up of the device regularly.

Daily inspection: Basic check-up items to detect if there were any abnormalities during operation are:

- m Whether the motors are operating as expected.
- m Whether the installation environment is abnormal.
- m Whether the cooling system is operating as expected.
- m Whether any irregular vibration or sound occurred during operation.
- m Whether the motors are overheating during operation.
- m Always check the input voltage of the device with a voltmeter.

Periodic inspection: Before the check-up, always turn off the input power and remove the cover. Wait at least 10 minutes after all display lamps have gone out, and then confirm that the capacitors have fully discharged by measuring the voltage between \oplus and \ominus . It should be less than 25 V_{DC}.



DANGER

The following **will occur**, if you do not observe this danger information:

- m serious personal injury
- m death

*The hazard is: **electricity**.*

- m Disconnect power before processing!
- m Only qualified personnel shall install, wire and maintain the devices. Please take off any metal objects, such as watches and rings, before operation. And only insulated tools are allowed.
- m Never reassemble internal components or wiring.
- m Prevent electric shocks.

9.3.1 periodical maintenance

m Ambient environment

| Check items | Methods and criterion | Maintenance period | | |
|---|--|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| Check the ambient temperature, humidity, vibration and see if there are any dust, gas, oil or water drops | Visual inspection and measurement with equipment with standard specification | ○ | | |
| Check if there are any dangerous objects in the environment | Visual inspection | ○ | | |

m Voltage

| Check items | Methods and criterion | Maintenance period | | |
|---|---|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| Check if the voltage of main circuit and control circuit is correct | Measure with multimeter with standard specification | ○ | | |

m Keypad

| Check items | Methods and criterion | Maintenance period | | |
|-----------------------------------|-----------------------|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| Is the display clear for reading? | Visual inspection | ○ | | |
| Any missing characters? | Visual inspection | ○ | | |

m Mechanical parts

| Check items | Methods and criterion | Maintenance period | | |
|---|-----------------------------|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| If there is any abnormal sound or vibration | Visual and aural inspection | | ○ | |
| If there are any loose screws | Tighten the screws | | ○ | |
| If any part is deformed or damaged | Visual inspection | | ○ | |
| If there is any color change by overheating | Visual inspection | | ○ | |
| If there is any dust or dirt | Visual inspection | | ○ | |

9.3 Inspection intervals - maintenance notes

m Main circuit

| Check items | Methods and criterion | Maintenance period | | |
|---|--|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| If there are any loose or missing screws | Tighten or replace the screw | | ○ | |
| If machine or insulator is deformed, cracked, damaged or with changed color change due to overheating or ageing | Visual inspection NOTE: Please ignore the color change of copper plate | | ○ | |
| If there is any dust or dirt | Visual inspection | | ○ | |

m Terminals and wiring of main circuit

| Check items | Methods and criterion | Maintenance period | | |
|---|-----------------------|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| If the wiring shows change of color change or deformation due to overheat | Visual inspection | | ○ | |
| If the insulation of wiring is damaged or the color has changed | Visual inspection | | ○ | |
| If there is any damage | Visual inspection | | ○ | |

m DC capacity of main circuit

| Check items | Methods and criterion | Maintenance period | | |
|---|---|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| If there is any leakage of liquid, change of color, cracks or deformation | Visual inspection | ○ | | |
| Measure static capacity when required | Static capacity \geq initial value X 0.85 | | ○ | |

m Resistor of main circuit

| Check items | Methods and criterion | Maintenance period | | |
|---|--|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| If there is any peculiar smell or insulator cracks due to overheating | Visual inspection, smell | | ○ | |
| If there is any disconnection | Visual inspection or measure with multimeter after removing wiring between +1/+2 ~ - Resistor value should be within $\pm 10\%$ | | ○ | |

m Transformer and chokes of main circuit

| Check items | Methods and criterion | Maintenance period | | |
|--|------------------------------------|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| If there is any abnormal vibration or peculiar smell | Visual, aural inspection and smell | | ○ | |

m Magnetic contactor and relay of main circuit

| Check items | Methods and criterion | Maintenance period | | |
|--------------------------------|---|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| If there are any loose screws | Visual and aural inspection. Tighten screw if necessary | ○ | | |
| If the contact works correctly | Visual inspection | ○ | | |

m Printed circuit board and connector of main circuit

| Check items | Methods and criterion | Maintenance period | | |
|--|--|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| If there are any loose screws and connectors | Tighten the screws and press the connectors firmly in place. | | ○ | |
| If there is any peculiar smell and color change | Visual inspection and smell | | ○ | |
| If there is any crack, damage, deformation or corrosion | Visual inspection | | ○ | |
| If there is any leaked liquid or deformation in capacitors | Visual inspection | | ○ | |

m Cooling fan of cooling system

| Check items | Methods and criterion | Maintenance period | | |
|--|---|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| If there is any abnormal sound or vibration | Visual, aural inspection and turn the fan with hand (turn off the power before operation) to see if it rotates smoothly | | | ○ |
| If there is any loose screw | Tighten the screw | | | ○ |
| If there is any change of color due to overheating | Change fan | | | ○ |

9.3 Inspection intervals - maintenance notes

m Ventilation channel of cooling system

| Check items | Methods and criterion | Maintenance period | | |
|--|-----------------------|--------------------|-----------|----------|
| | | Daily | Half year | One year |
| If there is any obstruction in the heat sink, air intake or air outlet | Visual inspection | O | | |

REPAIR

In this chapter we describe, where the devices are repaired.

WARNING



The following **may occur**, if you disregard these safety notes:
m serious personal injury m death



*The danger is: **electricity**. After a faulty repair the device doesn't fulfill the safety instructions anymore.*

Have the devices been commissioned only by
Baumüller Nürnberg GmbH or the authorized service points.



SHUTDOWN, STORAGE

In this chapter we describe, how you decommission and store the device.

11.1 Safety instructions

h Refer to [ZFundamental safety instructions](#)– from page 11 and the information in [ZTransportation and packing](#)– from page 23.

The shutdown of the device may only be carried out by for this qualified personnel.



DANGER

The following will occur, if you disregard this safety note:

m serious personal injury m death

*The danger is: **Electricity and electrical charge, which was saved.** Electrical connections, which are not in a current-free state, carry hazardous voltage levels. The modules in the device (e. g. capacitors) also can carry hazardous charges after it was switched off!*

Assure, that all electric connections are current-free and are safe against re-start.

Before working, check at the electrical connections with suitable measuring devices, that the connections are off-circuit.

Remove the connections not until the safe isolation from supply has been checked.

The capacitors which are used in the device are **10 min.** after interruption of supply voltage discharged so far, that the connections can be demounted without danger.

11.2 Requirements to the executing personnel

The personnel, who is appointed to setting out of operation, must have the required knowledge and instructions, which is necessary for an execution according to the rules. Select the personnel in such a way, that the safety instructions, which are mounted to the device and its parts as well as to the connections, are understood and applied to.

11.3 Shutdown

Execute the setting out of operation as follows:

- 1 put the device off-circuit and assure the device against unintentional restart.
- 2 check the isolation from supply of all connections (earliest 10 minutes after switching off).
- 3 demount the connections and protect the connections according to the safety instructions.
- 4 document the shut down setting.

11.4 Demounting

The demounting assumes a completed, documented setting out of operation.



CAUTION

The following **may occur**, if you disregard these safety notes:

m minor to medium personal injury.

In case, while installing, you lift a device with unprotected hands, fingers/palm can be cut. If the device falls off, your feet can be cut up.



Wear safety gloves



Wear safety shoes

- 1 secure the device against falling off/out.
- 2 loosen all mechanical connections.
- 3 lift the device out of the control cabinet.
- 4 store the device in a suitable packing.
- 5 at transportation pay attention to, that the device is not damaged by wrong storage or severe shocks, also see [ZTo be considered by transportation](#)– on page 23.

In case you want to dispose the device, additional data is available in chapter [ZDisposal](#)– from page 113.

11.5 Storage conditions

The device is maintenance-free. If you keep to the environmental conditions during the entire period of storage, you can assume, that the device will not be damaged. In case the environmental conditions during storage are not kept, you should assume that the device is damaged after storage.

The device should be kept in the shipping carton or crate before installation. In order to retain the warranty coverage, the device should be stored properly when it is not to be used for an extended period of time.

- m Store in a clean and dry location free from direct sunlight or corrosive fumes.
- m Store within an ambient temperature range of -20 °C to +60 °C (-4 to 140 °F).
- m Store within a relative humidity range of 0 % to 90 % and non-condensing environment.
- m Store within an air pressure range of 86 kPa to 106 kPa.
- m Store within a vibration of:
 <20 Hz: 9.80 m/s² (1 G) max.
 20 - 50 Hz: 5.88 m/s² (0.6 G)
- m Store within a pollution degree of 2 (good for factory type environment).



CAUTION

The following **can occur**, if you disregard this warning instruction:

- m Property damage

*The danger is: **incorrect environmental conditions.** Incorrect storage can damage/destroy the device.*

Assure, that the environmental conditions are kept during the entire period of storage:

- m DO NOT store in an area with rapid changes in temperature. It may cause condensation and frost.
- m DO NOT place on the ground directly. It should be stored properly. Moreover, if the surrounding environment is humid, you should put exsiccator in the package.
- m If the device is stored for more than 3 months, the temperature should not be higher than 30 °C. Storage longer than one year is not recommended, it could result in the degradation of the electrolytic capacitors.
- m When the device is not used for a long time after installation on building sites or places with humidity and dust, it's best to move the device to an environment as stated above.

11.6 Recommissioning

Execute commissioning as with a new device, see [ZMounting](#)— from page 33, [ZInstallation](#)— from page 43

DISPOSAL

In this chapter we describe the correct and safe disposal of the devices of the series **b maXX®**. During the disposal you will mainly get metal parts (iron- and non-iron metal), electronic scrap and plastics.

NOTE



Baumüller products do not belong to the scope of the EU guideline for the disposal of electrical and electronics devices (WEEE, 2002/96/EG). Therefore, no costs are to be carried by Baumüller for the canceling and disposal of old devices.

12.1 Safety instructions

h Refer to [ZFundamental safety instructions](#)— from page 11.

DANGER



The following **will occur**, if you disregard this safety note:

m serious personal injury m death



*The danger is: **electricity**. The containing components in the device (e. g. capacitors) can contain dangerous charges! The capacitors used in the device are after **10 min.** automatically so far discharged, that they can be demounted without danger.*

Demount the capacitors only then, if you have verified yourself of the isolation from supply.

12.2 Requirements to the executing personnel



CAUTION

The following **may occur**, if you disregard these safety notes:

m minor to medium personal injury.

*The danger is: **sharp edges**.* The components of the device, sheet metal components, heat sinks and so on can have sharp edges!

In case you lift a device during demounting with non-protected hands, your fingers/palms can be cut. If the device falls off, your feet can be cut up.



Wear safety gloves



Wear safety shoes



CAUTION

The following **can occur**, if you disregard this warning instruction:

m Environmental pollution

*The danger is: **incorrect disposal**.*

You may only dispose under consideration of the safety instructions. If necessary, also refer to the local regulations. In case you cannot execute a secure disposal, contact a certified disposal business.

Dangerous materials may result or may be set free from a fire.

Do not expose electronic components to high temperatures.

The inner insulation e. g. various power semiconductors hold beryllium oxide. When opened, the beryllium dust is dangerous to your health.

Do not open the electronical components.

12.2 Requirements to the executing personnel

The personnel, whom you instruct to dispose/demount the device must have the knowledge and training to execute these works properly. The personnel is to be selected in such a way, that the safety instructions on the device and its parts is understood and referred to by the personnel.

12.3 Disposal instructions

| | |
|----------------------|---|
| Preconditions | m The device has already properly been demounted. |
| | m All technical appliances for demounting are prepared and are technically in good order and condition. |

12.3.1 Modules

| | |
|----------------------------------|---|
| Sheet steel | Sheet steel must be given to the iron metal recycling. |
| Aluminium | Aluminium must be given to the non-iron metal recycling. |
| Aluminium/copper compound | Aluminium/copper compound must be given to the non-iron metal recycling. |
| Plastics | The plastic parts of the housing as well as the plastic covers and further small plastic parts must be given to the plastics recycling. |



CAUTION

The following **can occur**, if you disregard this warning instruction:

- m Environmental pollution

*The danger is: **incorrect disposal.***

Capacitors, semiconductor modules and electronic scrap is to be recycled as special waste.

| | |
|------------------------------|---|
| Capacitors | Capacitors are to be recycled as special waste. Thereby refer to the relevant instructions. |
| Semiconductor modules | Semiconductor modules are to be recycled as special waste. Thereby refer to the relevant instructions. |
| Electronic scrap | The electronic scrap from PCBs, which no further can be demounted, must be recycled as special waste. Thereby refer to the relevant instructions. |

12.4 Recycling plants/offices

Assure, that the disposal is carried out according to your company's regulations and the regulations of the disposal companies and official administrations. In case of doubt, contact the local business administration, which is responsible for your company or the environmental office.



APPENDIX A - ABBREVIATIONS

| | |
|------|---|
| ACI | Analog current input |
| ACM | Signal common analog input |
| AFM | Analog multi-function output |
| AVI | Analog voltage input |
| BM | Baumüller Nürnberg GmbH |
| DCM | Digital signal common multi-function input |
| EMC | Electromagnetic compatibility |
| EN | European standard |
| FWD | Forward speed direction |
| IP | Class of protection |
| MCM | Multi-function photocoupler output |
| MI | Multi-function input |
| MO1 | Multi-function output |
| N.C | Normally connected |
| N.O. | Normally open |
| PE | Protected earth |
| RCD | Residual-current-operated protective device |
| REV | Reverse speed direction |



APPENDIX B - SPARE PARTS AND ACCESSORIES

In this appendix we are listing the spare-/accessory parts for the devices of the series **b maXX[®] 1000**. In case you have questions and suggestions according the accessories, do not hesitate to contact our product management.

B.1 Chopper units and braking resistors



NOTE

Please only use Baumüller resistors and recommended values. Other resistors and values will void Baumüller's warranty. Please contact your nearest Baumüller representative for use of special resistors. The brake unit should be at least 10 cm away from the device to avoid possible interference.

B.1.1 Select a chopper unit /braking resistor

- in progress -

for further information please contact your nearest Baumüller representative.



NOTE

- m Please select the brake unit and/or braking resistor according to the table.
- m If damage to the device or other equipment is due to the fact that the braking resistors and the braking resistors in use are not provided by Baumüller, the warranty will be void.
- m Take into consideration the safety of the environment when installing the braking resistors.
- m If the minimum resistance value is to be utilized, consult local dealers for the calculation of the power in Watt.
- m Please select thermal relay trip contact to prevent resistor over load. Use the contact to switch power off to the device!
- m When using more than 2 chopper units, equivalent resistor value of parallel brake unit can't be less than the value in the column „Minimum equivalent resistor value for each device“ (see table below).
- m Please read the wiring information in the user manual of the brake unit thoroughly prior to installation and operation.

| Voltage | Device | Appli- cable motor kW | Full load torque Nm | Resistor value spec for each device | Chopper unit model and quantity | | Braking resis- tors model and quantity | | Braking torque 10 % ED | Min. equiva- lent resistor value for each device | Typical thermal overload relay value |
|-------------|--------|--------------------------------|------------------------------|---|---------------------------------------|---|---|---|------------------------------|---|---|
| 230V series | BM1211 | 0.2 | 0.110 | 200 W 250 Ω | BM1-BTE-23 | 1 | R250-200-20 | 1 | 320 | 200 Ω | 2 A |
| | BM1212 | 0.4 | 0.216 | 200 W 250 Ω | BM1-BTE-23 | 1 | R250-200-20 | 1 | 170 | 100 Ω | 2 A |
| | BM1213 | 0.75 | 0.427 | 200 W 150 Ω | BM1-BTE-23 | 1 | R150-200-20 | 1 | 140 | 80 Ω | 2 A |
| | BM1224 | 1.5 | 0.849 | 300 W 85 Ω | internal | | | | 125 | 40 Ω | |
| | BM1225 | 2.2 | 1.262 | 450 W 60 Ω | internal | | | | 120 | 40 Ω | |
| 460V series | BM1412 | 0.4 | 0.216 | 300 W 400 Ω | BM1-BTE-46 | 1 | R400-300-20 | 1 | 400 | 400 Ω | 1 A |
| | BM1413 | 0.75 | 0.427 | 300 W 400 Ω | BM1-BTE-46 | 1 | R400-300-20 | 1 | 200 | 200 Ω | 1 A |
| | BM1414 | 1.5 | 0.849 | 400 W 300 Ω | BM1-BTE-46 | 1 | R150-200-20 | 2 | 140 | 160 Ω | |
| | BM1425 | 2.2 | 1.262 | 600 W 200 Ω | internal | | R400-300-20 | 2 | 140 | 140 Ω | |
| | BM1426 | 3.7 | 2.080 | 750 W 140 Ω | internal | | | | 125 | 96 Ω | |
| | BM1437 | 5.5 | 3.111 | 1100 W 96 Ω | internal | | | | 120 | 96 Ω | |
| | BM1438 | 7.5 | 4.148 | 1500 W 69 Ω | internal | | | | 125 | 69 Ω | |
| | BM1439 | 11 | 6.186 | 2000 W 53 Ω | internal | | | | 108 | 53 Ω | |

B.1.2 Chopper units BM1-BTE

- in progress -

for further information please contact your nearest Baumüller representative.

m Specification

| Model BM1- | | BTE-23 230 V series | BTE-46 460 V series |
|--------------------------|---|--|---|
| Max. motor power (kW) | | 1.5 | 1.5 |
| Output rating | Max. peak discharge current (A) 10 % ED | 3.6 | 1.8 |
| | Continuous discharge current (A) | 1.141 | 0.57 |
| | Braking start-up voltage (DC) | 328 V/345 V/362 V/ 380 V/397 V/415 V ±3 V | 656 V/690 V/725 V/ 760 V/795 V/830 V ±6 V |
| Input rating | DC Voltage | 200 to 400 V _{DC} | 400 to 800 V _{DC} |
| Protection | Heat sink overheat | Temperature over +95 °C | |
| | Power charge display | Blackout until bus (+/-) voltage below 50 V _{DC} | |
| Environment | Installation location | Indoor (no corrosive gases, metallic dust) | |
| | Operating temperature | -10 to +50 | |
| | Storage temperature | -20 to +60 | |
| | Humidity | 90 % R.H., non-condensing | |
| | Vibration | 9.8m/s ² (1G) under 20Hz 2m/s ² (0.2G) at 20 ~ 50Hz | |
| Mechanical configuration | | Wall-mounted enclosed type IP20 | |

m Dimension
(all dimensions in mm)

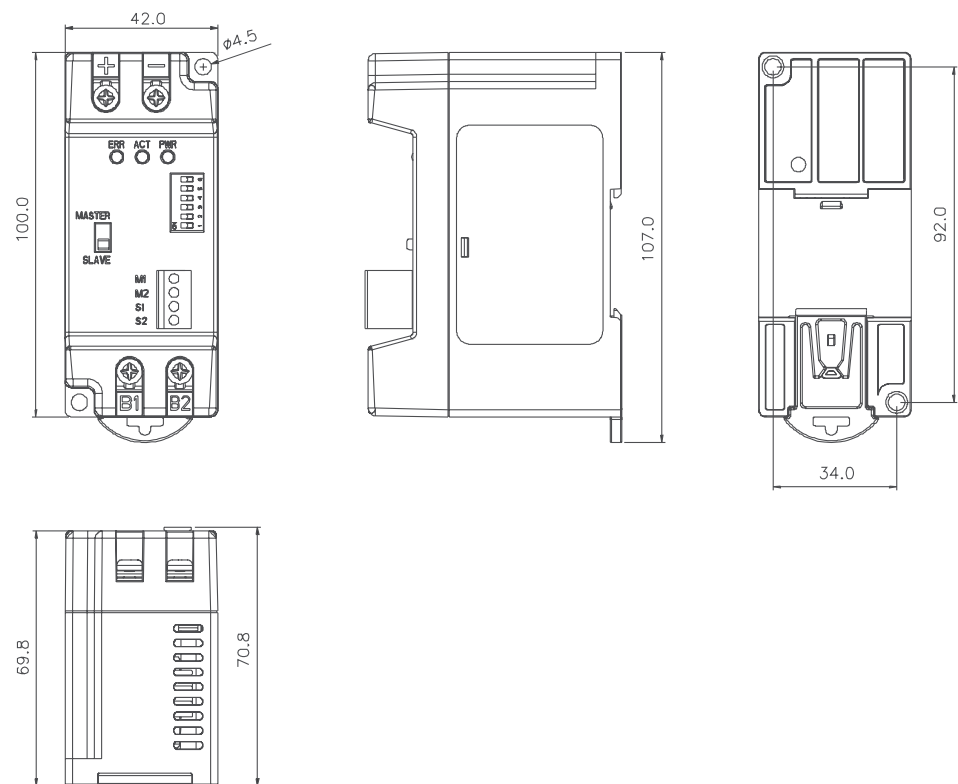


Figure 61: Dimensions chopper unit

m DIN rail installation

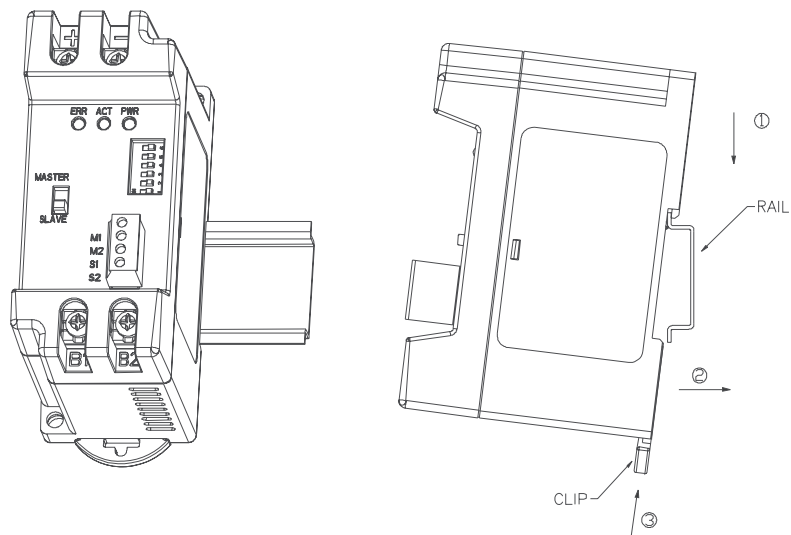


Figure 62: DIN rail installation chopper unit

m Function explanation

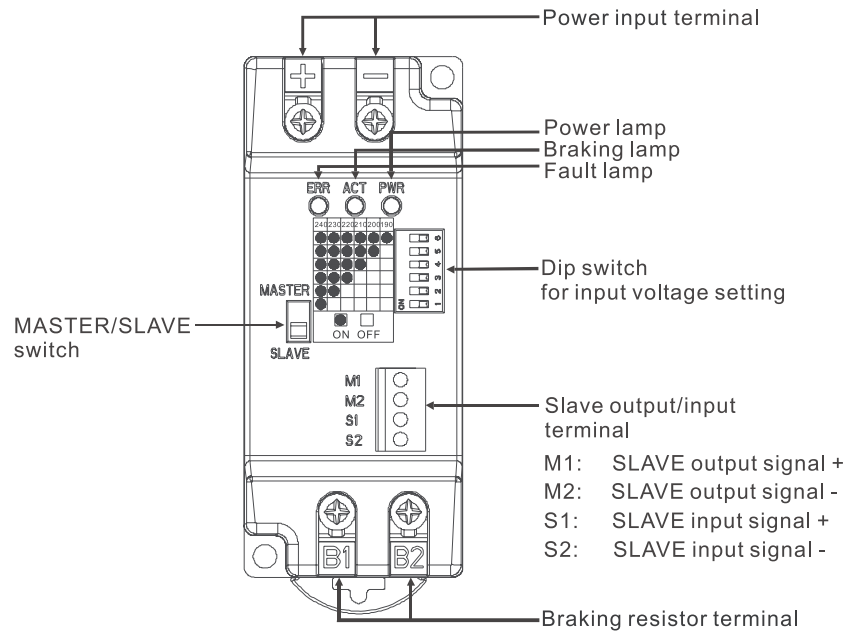


Figure 63: Parts of chopper unit

n Terminals

| | Terminal symbol | Wire gauge AWG/mm ² | Terminal |
|---------------------|------------------|--|----------|
| Power input circuit | +(P), -(N) | 20~22AWG/0.5~0.3mm ² | M4 screw |
| Braking resistor | B1, B2 | 20~22AWG/0.5~0.3mm ² | M4 screw |
| SLAVE circuit | M1, M2 S1, S2 | 24AWG/0.2mm ² M1, M2, S1, S2 with shielded wires | M2 screw |

m Basic wiring diagram

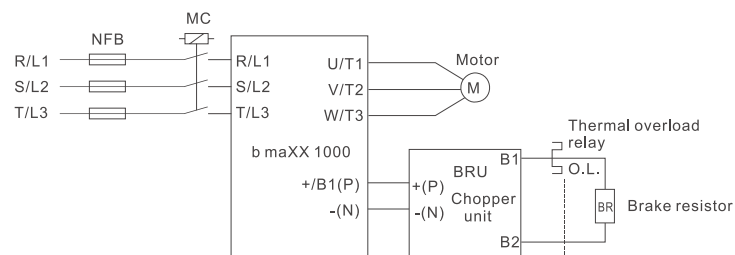


Figure 64: Wiring diagram chopper unit

NOTE

Do not wire terminal -(N) to neutral point of power system.



**WARNING**

The following **may occur**, if you disregard these safety notes:

m serious personal injury m death

- ☐ Do not proceed with wiring while power is applied to the circuit.
- ☐ The wire gauge and distance must comply with the electrical data.
- ☐ The +(P), -(N) terminals of the **b maXX[®] BM1000**, connected to the chopper unit, must be confirmed for correct polarity lest the drive and the chopper unit be damaged when power on.
- ☐ When the chopper unit performs braking, the wires connected to +(P), -(N), B1 and B2 would generate a powerful electromagnetic field for a moment due to high current passing through. These wires should be wired separately from other low voltage control circuits so that do not make interference or mis-operation
- ☐ Wiring distance

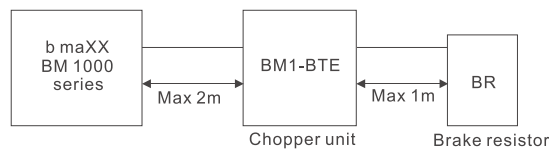


Figure 65: Wiring distance chopper unit

- ☐ Inflammable solids, gases or liquids must be avoided at the location where the braking resistor is installed. The braking resistor had better be installed in individual metallic box with forced air-cooling.
- ☐ Connect the ground terminal to PE. The ground lead must be at least the same gauge wire as leads +(P), -(N).
- ☐ Please install the braking resistor with forced air-cooling or the equivalent when frequent deceleration braking is performed (over 10 % ED).
- ☐ To avoid personal injury, do not connect/disconnect wires or regulate the setting of the chopper unit while power on. Do not touch the terminals of related wiring and any component on PCB lest users be damaged by extreme dangerous DC high voltage.
- ☐ The ring terminals are suggested to be used for main circuit wiring. Make sure the terminals are fastened before power on.

m Operation explanation

- n For safety consideration, install an overload relay between the chopper unit and the braking resistor. In conjunction with the magnetic contactor (MC) prior to the drive, it can perform complete protection against abnormality.
- n The purpose of installing the thermal overload relay is to protect the braking resistor from damage due to frequent braking, or due to braking unit keeping operating resulted from unusual high input voltage. Under such circumstance, just turn off the power to avoid damaging the braking resistor.
- n Please refer to [ZSelect a chopper unit /braking resistor–](#) on page 120 for the specification of the thermal overload relay.

m Definition of braking usage ED %

The definition of the braking usage ED % is for assurance of enough time for the chopper unit and braking resistor to dissipate away heat generated by braking. When the braking resistor heats up, the resistance would increase with temperature, and braking torque would decrease accordingly.

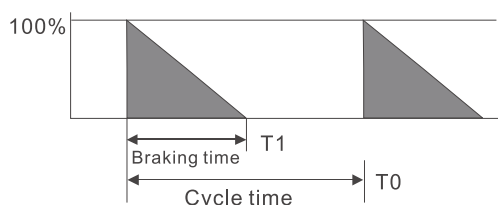


Figure 66: Braking usage ED %

$$ED[\%] = \frac{T1}{T0} \cdot 100[\%]$$

m Voltage settings

The power source of the chopper unit is the DC power from the + (P) and - (N) terminals of the **b maXX® BM1000**. Therefore, it is an important step to set the voltage by the input voltage of the **b maXX® BM1000** before operation. This setting will affect the voltage level of the chopper unit.

NOTE

- ☐ Before voltage setting, make sure the power has been turned off.
- ☐ Please set power voltage as the possible highest voltage for unstable power system. Take 380V_{AC} power system for example. If the voltage may be up to 410V_{AC}, 415V_{AC} should be regulated.
- ☐ For **b maXX® BM1000**, please set parameter (over voltage stall prevention) as „close“ to disable over-voltage stall prevention, to ensure stable deceleration characteristic.

| 230 V series power voltage * | Braking start-up voltage DC Bus (+(P), -(N)) voltage |
|---------------------------------|--|
| 190 V _{AC} | 330 V _{DC} |
| 200 V _{AC} | 345 V _{DC} |
| 210 V _{AC} | 360 V _{DC} |
| 220 V _{AC} | 380 V _{DC} |
| 230 V _{AC} | 400 V _{DC} |
| 240 V _{AC} | 415 V _{DC} |

| 460 V series power voltage * | Braking start-up voltage DC Bus (+(P), -(N)) voltage |
|---------------------------------|--|
| 380 V _{AC} | 660 V _{DC} |
| 400 V _{AC} | 690 V _{DC} |
| 420 V _{AC} | 725 V _{DC} |
| 440 V _{AC} | 760 V _{DC} |
| 460 V _{AC} | 795 V _{DC} |
| 480 V _{AC} | 830 V _{DC} |

* Input power with tolerance ±10 %



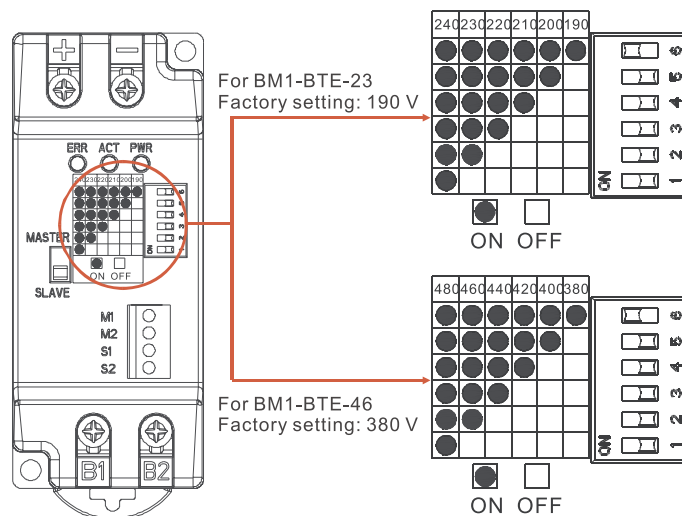


Figure 67: Voltage setting chopper unit

m Master/Slave setting

The MASTER/SLAVE jumper is set „MASTER“ as factory setting. The „SLAVE“ setting is applied to two or more chopper units in parallel, making these chopper units be enabled/disabled synchronously. Then the power dissipation of each unit will be equivalent so that they can perform the braking function completely.

n Wiring example

The SLAVE braking application of three chopper units is shown. After wiring, the jumper of first unit shall be set as „MASTER“ and that of others must be set as „SLAVE“ to complete the system installation.

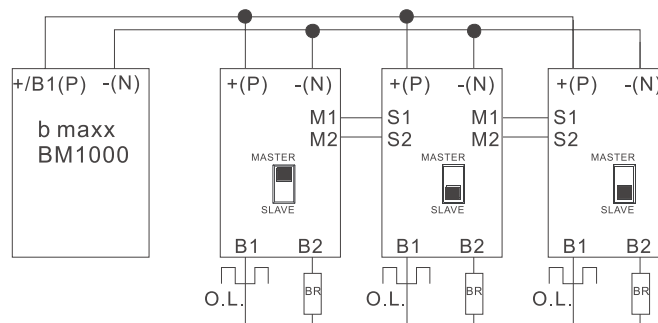


Figure 68: Wiring example Master/Slave setting

B.1.3 Dimensions and weights for braking resistors

- in progress -

for further information please contact your nearest Baumüller representative.

(all dimensions are in millimeter)

R150-200-20 (150 Ω / 200 W)

R250-200-20 (250 Ω / 200 W)

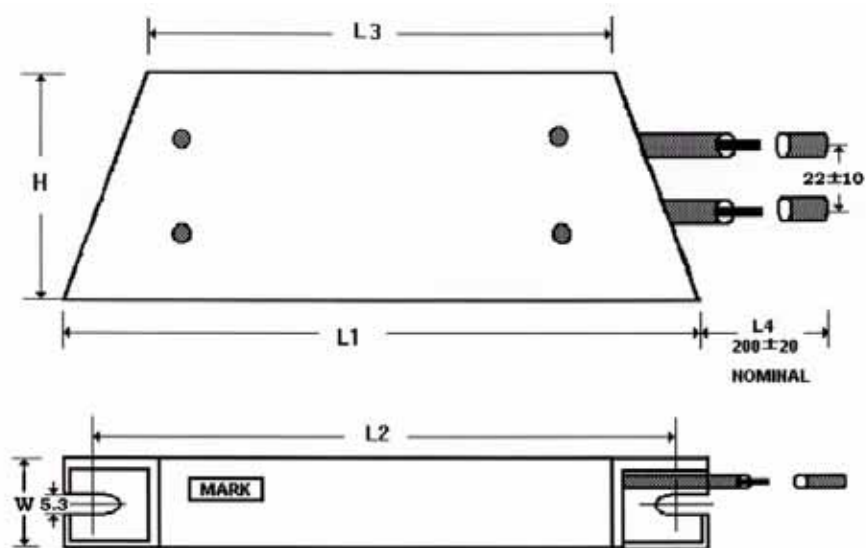


Figure 69: Braking resistor 1

| Model no. | L1 | L2 | L3 | W | H |
|-------------|-----|-----|-----|----|----|
| R400-300-20 | 165 | 150 | 110 | 30 | 60 |

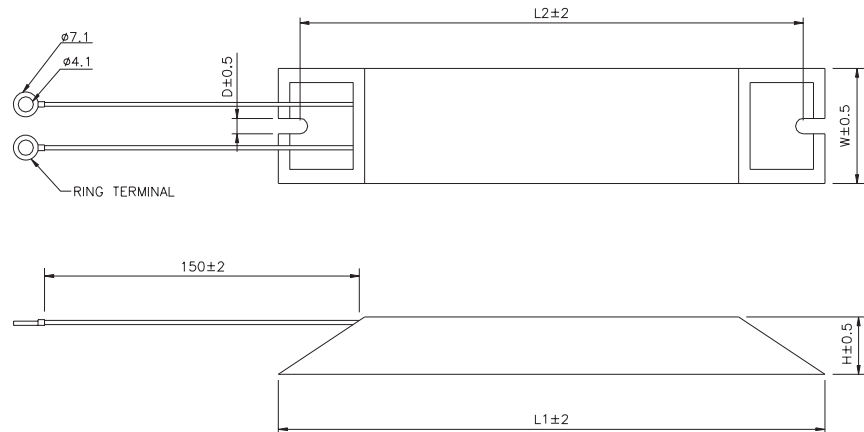
R400-300-20 (400 Ω / 300 W)

Figure 70: Braking resistor 2

| Model no. | L1 | L2 | H | D | W | Max. weight (g) |
|-------------|-----|-----|----|-----|----|-----------------|
| R400-300-20 | 215 | 200 | 30 | 5.3 | 60 | 750 |

B.2 Mains filters

In order to comply with the required limit values of the EMC product standard an additional filter can be necessary for the device.

NOTE

The models b maXX[®] 1000 have an built-in EMI filter.

An additional mains filter is necessary for cable lengths > 15 m (cable device - motor).



| Device | Filter | Specification | Dimension (length x width x depth) | Manufacturer |
|--------|---------|----------------------------|---------------------------------------|-----------------------|
| BM1211 | MDF16 | 16 A / 240 V _{AC} | 150 x 65 x 48 mm | Fa. DELTRON- EMCON |
| BM1212 | | | | |
| BM1213 | | | | |
| BM1224 | MDF25 | 25 A / 240 V _{AC} | 174 x 120 x 77 mm | |
| BM1225 | | | | |
| BM1412 | KMF306A | 3-phase / 6 A | 179 x 45 x 79 mm | |
| BM1413 | | | | |
| BM1414 | | | | |
| BM1425 | KMF318A | 3-phase / 18 A | 229 x 55 x 114 mm | |
| BM1426 | | | | |
| BM1437 | KMF325A | 3-phase / 25 A | 229 x 55 x 114 mm | |
| BM1438 | | | | |
| BM1439 | | | | |

B.3 Chokes**B.3.1 Mains chokes recommended values**

230V, 50/60Hz, 1-phase

| Device | kW | Fundamental A | Max. continuous A | Inductance (mH) |
|--------|------|------------------|----------------------|-----------------|
| | | | | 3~5 % impedance |
| BM1211 | 0.2 | 4 | 6 | 6.5 |
| BM1212 | 0.4 | 5 | 7.5 | 3 |
| BM1213 | 0.75 | 8 | 12 | 1.5 |
| BM1224 | 1.5 | 12 | 18 | 1.25 |
| BM1225 | 2.2 | 18 | 27 | 0.8 |

460V, 50/60Hz, 3-phase

| Device | kW | Fundamental A | Max. continuous A | Inductance (mH) | |
|--------|------|------------------|----------------------|-----------------|--------------|
| | | | | 3% impedance | 5% impedance |
| BM1412 | 0.4 | 2 | 3 | 20 | 32 |
| BM1413 | 0.75 | 4 | 6 | 9 | 12 |
| BM1414 | 1.5 | 4 | 6 | 6.5 | 9 |
| BM1425 | 2.2 | 8 | 12 | 5 | 7.5 |
| BM1426 | 3.7 | 8 | 12 | 3 | 5 |
| BM1437 | 5.5 | 12 | 18 | 2.5 | 4.2 |
| BM1438 | 7.5 | 18 | 27 | 1.5 | 2.5 |
| BM1439 | 11 | 25 | 37.5 | 1.2 | 2 |

B.3.2 Output chokes recommended values

230V, 50/60Hz, 1-phase

| Device | kW | Fundamental A | Max. continuous A | Inductance (mH) | |
|--------|------|------------------|----------------------|-----------------|---------------|
| | | | | 3 % impedance | 5 % impedance |
| BM1211 | 0.2 | 4 | 4 | 9 | 12 |
| BM1212 | 0.4 | 6 | 6 | 6.5 | 9 |
| BM1213 | 0.75 | 8 | 12 | 3 | 5 |
| BM1224 | 1.5 | 8 | 12 | 1.5 | 3 |
| BM1225 | 2.2 | 12 | 18 | 1.25 | 2.5 |

460V, 50/60Hz, 3-phase

| Device | kW | Fundamental amps | Max. continuous amps | Inductance (mH) | |
|--------|------|---------------------|-------------------------|-----------------|---------------|
| | | | | 3 % impedance | 5 % impedance |
| BM1412 | 0.4 | 2 | 3 | 20 | 32 |
| BM1413 | 0.75 | 4 | 6 | 9 | 12 |
| BM1414 | 1.5 | 4 | 6 | 6.5 | 9 |
| BM1425 | 2.2 | 8 | 12 | 5 | 7.5 |
| BM1426 | 3.7 | 12 | 18 | 2.5 | 4.2 |
| BM1437 | 5.5 | 18 | 27 | 1.5 | 2.5 |
| BM1438 | 7.5 | 18 | 27 | 1.5 | 2.5 |
| BM1439 | 11 | 25 | 37.5 | 1.2 | 2 |

B.4 Fuses for device-protection



NOTE

The following fuses are UL-listed.

Smaller fuses than those shown in the table are permitted.

| Model | I (A) Input | I (A) Output | Line Fuse | |
|--------|----------------|-----------------|-----------|--------------|
| | | | I (A) | Bussmann P/N |
| BM1211 | 4.9 | 1.6 | 10 | JJN-10 |
| BM1212 | 6.5 | 2.5 | 15 | JJN-15 |
| BM1412 | 1.9 | 1.5 | 5 | JJS-6 |
| BM1213 | 9.7 | 4.2 | 20 | JJN-20 |
| BM1413 | 3.2 | 2.5 | 5 | JJS-6 |
| BM1224 | 15.7 | 7.5 | 30 | JJN-30 |
| BM1414 | 4.3 | 4.2 | 10 | JJS-10 |
| BM1225 | 24 | 11 | 50 | JJN-50 |
| BM1425 | 7.1 | 5.5 | 15 | JJS-15 |
| BM1426 | 11.2 | 8.2 | 20 | JJS-20 |
| BM1437 | 14 | 13 | 30 | JJS-30 |
| BM1438 | 19 | 18 | 40 | JJS-40 |
| BM1439 | 26 | 24 | 50 | JJS-50 |

B.5 Non-fuse circuit breaker

Per UL 508C, paragraph 45.8.4, part a:

- m For 1-phase drives, the current rating of the breaker shall be 4 times maximum input current rating.
- m For 3-phase drives, the current rating of the breaker shall be 4 times maximum output current rating.

(Refer to [ZD.3 Electrical data](#)— from page 143 for rated input/output current)

| 1-phase | |
|---------|----------------------------------|
| Model | Recommended non-fuse breaker [A] |
| BM1211 | 10 |
| BM1212 | 15 |
| BM1213 | 20 |
| BM1224 | 30 |
| BM1225 | 50 |

| 3-phase | |
|---------|----------------------------------|
| Model | Recommended non-fuse breaker [A] |
| BM1412 | 5 |
| BM1413 | 5 |
| BM1414 | 10 |
| BM1425 | 15 |
| BM1426 | 20 |
| BM1437 | 30 |
| BM1438 | 40 |
| BM1439 | 50 |

B.6 Digital keypad

BM1-HMI-01-00-00



Figure 71: Digital keypad

B.7 Digital keypad cable

| Model | Length |
|---------------|--------|
| K-HMI-BM1-006 | 0.6 m |
| K-HMI-BM1-010 | 1.0 m |
| K-HMI-BM1-020 | 2.0 m |
| K-HMI-BM1-030 | 3.0 m |
| K-HMI-BM1-050 | 5.0 m |

B.8 DIN rail

B.8.1 BM1-MPL-01

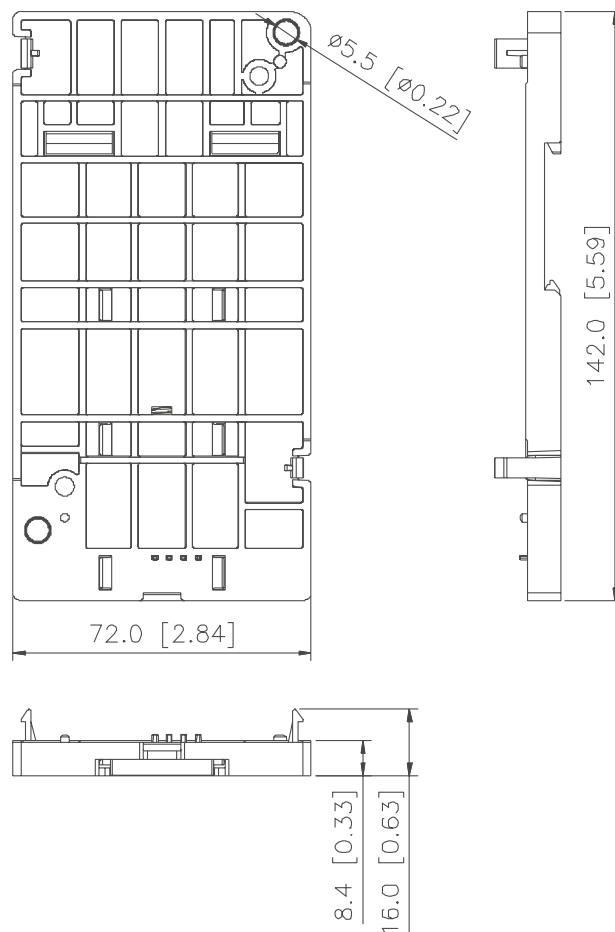


Figure 72: DIN rail 1

B.8.2 BM1-MPL-02

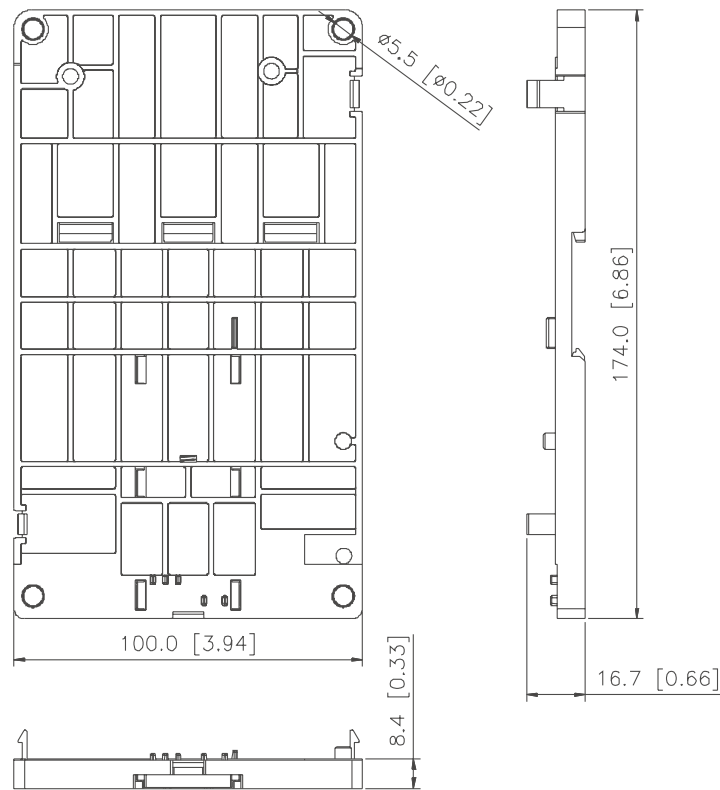


Figure 73: DIN rail 2

B.8.3 BM1-EPL-00

EMC earthing plate for shielding cable

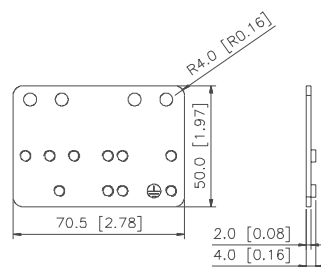


Figure 74: MKE-EP

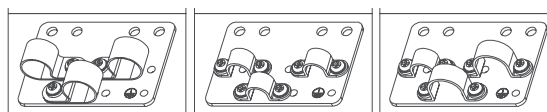


Figure 75: Earthing plate for shielding cable

B.9 Accessories CANopen

m Connection cables

| Type | Model | Length [m] | Part no. |
|------------------------|----------------------------|------------|------------|
| BM4-CAN-K-31-01 | RJ45 male, Sub-D male | 1 | 346568 |
| BM4-CAN-K-31-02 | | 2 | on request |
| BM4-CAN-K-31-02 | | 3 | 346571 |
| BM4-CAN-K-31-05 | | 5 | on request |
| BM4-CAN-K-31-10 | | 10 | on request |
| BM4-CAN-K-32-01 | RJ45 male, Sub-D female | 1 | 346572 |
| BM4-CAN-K-32-02 | | 2 | on request |
| BM4-CAN-K-32-03 | | 3 | 346573 |
| BM4-CAN-K-32-05 | | 5 | on request |
| BM4-CAN-K-32-10 | | 10 | on request |
| BM4-CAN-K-33-01 | RJ45 male, RJ45 male | 1 | 346577 |
| BM4-CAN-K-33-02 | | 2 | on request |
| BM4-CAN-K-33-03 | | 3 | on request |
| BM4-CAN-K-33-05 | | 5 | on request |
| BM4-CAN-K-33-10 | | 10 | on request |

m Terminating plug RJ45 (CAN, RJ45 with pin-assignment according CIA standard, 120 Ω , 0,25 W)

| Type | Part no. |
|--------------------|----------|
| BM4-CAN-T01 | 346408 |



APPENDIX C - DECLARATION OF CONFORMITY/ MANUFACTURER, UL - CERTIFICATION

In this section we provide general information about EU directives, the CE symbol and the Declaration of Conformity/by Manufacturer.

C.1 What is an EU directive?

EU directives specify requirements. The directives are written by the relevant bodies within the EU and are implemented by all the member countries of the EU in national law. In this way the EU directives guarantee free trade within the EU.

An EU directive only contains essential minimum requirements. You will find detailed requirements in standards, to which references are made in the directive.

C.2 What the CE symbol indicates

a) The CE marking symbolizes conformity to all the obligations incumbent on manufacturers for the product by virtue of the Community directives providing for its affixing.

...

b) The CE marking affixed to industrial products symbolizes the fact that the natural or legal person having affixed or been responsible for the affixing of the said marking has verified that the product conforms to all the Community total harmonization provisions which apply to it and has been the subject of the appropriate conformity evaluation procedures.

...

Council Decision 93/465/EEC, Annex I B. a) + c)

We affix the CE mark to the equipment and to the documentation as soon as we have established that we have satisfied the requirements of the relevant directives.

All converters and control systems supplied by the Baumüller Nürnberg GmbH satisfy the requirements of 73/23/EEC (Low Voltage Directive).

As all converters and control systems comply with the requirements of the harmonized standards EN50178, EN 60204-1, EN 60529 and HD625.1 S1, the protection targets of 73/23/EEC are reached.

With specified application of this Baumüller equipment in your machinery, you can act on the assumption that the equipment satisfies the requirements of 98/37/EG (machinery directive). Therefore the equipment is developed and constructed in such a way, that the requirements of the harmonized standard EN 60204-1 can be met by the electrical installation.

Compliance with 89/336/EEC (EMC Directive) depends on how the equipment is installed. Since you are performing installation yourself, it is you who are responsible for complying with 89/336/EEC.

A declaration of conformity on the EMC directive therefore cannot be issued.

We will provide you with support in the form of EMC information. You will find this information in the operating manual and in “filters for main applications”. When you have complied with all the requirements we impose in this documentation, you can assume that the drive satisfies the requirements of the EMC Directive.

The limit values and requirements for variable-speed electrical drives are determined in the harmonized product standard EN 61800-3. If you are erecting an installation, for which a declaration of conformity on the EMC directive must be generated, it may be necessary to specify several harmonized standards, which you have used for the compliance of the protection targets of the directive. The harmonized product standard EN 61800-3 has to be used with electrical drives.

To enable you to market your machine within the EU, you must be in possession of the following:

- m Conformity mark (CE mark)
- m Declaration(s) of Conformity regarding the directive(s) relevant to the machine

C.3 Definition of the term Declaration of Conformity

A Declaration of Conformity as defined by this documentation is a declaration that the electrical equipment brought into circulation conforms to all the relevant fundamental safety and health requirements.

By issuing the Declaration of Conformity in this section the Baumüller Nürnberg GmbH declares that the equipment conforms to the relevant fundamental safety and health requirements resulting from the directives and standards which are listed in the Declaration of Conformity.

C.4 Definition of the term Manufacturer's Declaration

A Declaration by Manufacturer as defined by this documentation is a declaration that the machine/safety component brought into circulation conforms to all the relevant fundamental safety and health requirements.

By issuing the Declaration of Conformity in this section the Baumüller Nürnberg GmbH declares that the equipment conforms to the relevant fundamental safety and health requirements resulting from the directives and standards which are listed in the Declaration of Conformity.

The Baumüller equipment is integrated into a machine. For health and safety, of the users for example, it is important for the entire machine to conform to all the relevant fundamental safety and health requirements. For this reason the Baumüller Nürnberg GmbH draws attention in the Declaration by Manufacturer to the fact that it is prohibited to put the machine as a whole into operation before it has been declared that the machine conforms to the provisions of the Machinery Directive.

C.5 UL-certification

UL is a mark of conformity, which is assigned from **Underwriters Laboratories Inc.** (www.ul.com), an American company. The UL-certification is not statutory regulated, but takes place voluntarily.

In order to be allowed to mark equipments and components with the UL-mark of conformity, tests must have to be done, which are attended and documented by an UL-inspector. Only if all necessary tests have been passed and regular product monitoring at the production process of the equipment or the components has been passed without objections, the UL-mark of conformity may be attached to the equipment under test.

Line filters of the company Baumüller Nürnberg GmbH are checked in accordance of the UL-standard UL 508C (UL-Standard for Safety for Power Conversion Equipment) and are recorded under the category control number NMMS. The product- and test description is recorded under file-no. E179860.

Only if all necessary tests have been completely carried out the C-mark may be attached to the equipments or components. If single tests have not already taken place at the manufacturer's, but are carried out not until at the user's, then only the U-mark may be attached.

With products of the Baumüller Nürnberg GmbH all tests are already completed at the UL-certification process, so that they may be marked with the C-mark.

In case with the UL-certification process also standards of the CSA (**C**anadian **S**tandard **A**ssociation) are considered, then instead of the C- or U-mark the cC or U-mark may be attached to the product.

With products of the company Baumüller Nürnberg GmbH the CSA-standard Norm C 22.2 was considered, that's why they are marked with the cC-mark.

If products of Baumüller Nürnberg GmbH are mounted into an UL-certified installation, then certain application-, mounting- and installation notices must be considered, which are upon the functioning of the device. We have marked these notes in the manual with „UL 508C ...“. Only if you follow these notes and apply to them you may go by it, that the installation has been mounted UL-conform.



APPENDIX D - TECHNICAL DATA

In this chapter you find the detailed technical data for all sizes of the device series **b maXX® BM1000**.

D.1 Required environmental conditions

D.1 Required environmental conditions

| | | |
|---------------------------|-----------------------------|---|
| Operation | Air Temperature: | -10 to +50 °C (14 to 122 °F) |
| | | -10 to +40 °C (14 to 104 °F) for side-by-side mounting |
| | Relative Humidity: | < 90 %, no condensation allowed |
| | Atmospheric pressure: | 86 to 106 kPa |
| | Installation Site Altitude: | < 1000 m |
| | Vibration: | < 20 Hz: 9.80 m/s ² (1G) max 20 to 50 Hz: 5.88 m/s ² (0.6 G) max |
| Storage Transportation | Temperature: | -20 °C to +60 °C (-4 °F to 140 °F) |
| | Relative Humidity: | < 90 %, no condensation allowed |
| | Atmosphere pressure: | 86 to 106 kPa |
| | Vibration: | <20 Hz: 9.80 m/s ² (1 G) max 20 to 50 Hz: 5.88 m/s ² (0.6 G) max |
| Pollution Degree | 2 | suitable for a factory type environment. |

NOTE



- m Operating, storing or transporting the **b maXX® BM1000** outside these conditions may cause damage to the device.
- m Failure to observe these precautions may void the warranty!

D.2 Non-electrical data

| Device b maXX® BM1000 | Dimensions (W x H x D) | Weight with controller, without plug-in modules | Noise emission |
|-------------------------------------|---------------------------|--|-----------------------------|
| Frame 1 | 72 x 142 x 152 mm | 1.2 kg | max. 54 db(A) ¹⁾ |
| Frame 2 | 100 x 174 x 152 mm | 1.9 kg | max. 54 db(A) ¹⁾ |
| Frame 3 | 130 x 260 x 170 mm | 4.2 kg | max. 63 db(A) ¹⁾ |

¹⁾ 98/37/EG, appendix I, chapter 1.7.4.f, paragraph 8


D.3 Electrical data

| Voltage | | 230 V series | | | | |
|-----------------------------------|-----------------------------|---|------|------|-------------|------|
| BM | | 1211 | 1212 | 1213 | 1224 | 1225 |
| Max. applicable motor output (kW) | | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 |
| Output rating | Rated output capacity (kVA) | 0.6 | 1.0 | 1.6 | 2.9 | 4.2 |
| | Rated output current (A) | 1.6 | 2.5 | 4.2 | 7.5 | 11.0 |
| | Maximum output voltage (V) | 3-phase proportional to input voltage | | | | |
| | Output frequency (Hz) | 0.1 to 600 Hz | | | | |
| | Carrier frequency (kHz) | 1 to 15 | | | | |
| Input rating | Rated input current (A) | single | | | | |
| | | 4.9 | 6.5 | 9.5 | 15.7 | 24 |
| | Rated voltage/frequency | single 200 to 240 V, 50/60 Hz | | | | |
| | Voltage tolerance | ±10 % (180 to 264 V) | | | | |
| | | Frequency tolerance ±5 % (47 to 63 Hz) | | | | |
| Cooling method | | natural cooling | | | fan cooling | |

| Voltage | | 460 V series | | | | | | | |
|-----------------------------------|-----------------------------|---|------|------|-------------|------|------|------|------|
| BM | | 1412 | 1413 | 1414 | 1425 | 1426 | 1437 | 1438 | 1439 |
| Max. applicable motor output (kW) | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 |
| Output rating | Rated output capacity (kVA) | 1.2 | 2.0 | 3.3 | 4.4 | 6.8 | 9.9 | 13.7 | 18.3 |
| | Rated output current (A) | 1.5 | 2.5 | 4.2 | 5.5 | 8.2 | 13 | 18 | 24 |
| | Maximum output voltage (V) | 3-phase proportional to input voltage | | | | | | | |
| | Output frequency (Hz) | 0.1 to 600 Hz | | | | | | | |
| | Carrier frequency (kHz) | 1 to 15 | | | | | | | |
| Input rating | Rated input current (A) | 3-phase | | | | | | | |
| | | 1.9 | 3.2 | 4.3 | 7.1 | 11.2 | 14 | 19 | 26 |
| | Rated voltage/frequency | 3-phase, 380 to 480 V, 50/60 Hz | | | | | | | |
| | Voltage tolerance | ±10 % (342 to 528 V) | | | | | | | |
| | | Frequency tolerance ±5 % (47 to 63 Hz) | | | | | | | |
| Cooling method | | natural cooling | | | fan cooling | | | | |

D.4 General specifications

| | | | |
|---------------------------|----------------------------------|-----------------|---|
| Control characteristics | Control system | | SPWM (Sinusoidal Pulse Width Modulation) control (V/f or sensorless vector control) |
| | Frequency setting resolution | | 0.01 Hz |
| | Output frequency resolution | | 0.01 Hz |
| | Torque characteristics | | Including the auto-torque/auto-slip compensation; starting torque can be 150 % at 3.0 Hz |
| | Overload endurance | | 150 % of rated current for 1 minute |
| | Skip frequency | | Three zones, setting range 0.1 to 600 Hz |
| | Acceleration/deceleration time | | 0.1 to 600 seconds (2 Independent settings for accel/decel time) |
| | Stall prevention level | | Setting 20 to 250 % of rated current |
| | DC braking | | Operation frequency 0.1 to 600.0 Hz, output 0 to 100 % rated current Start time 0 to 60 seconds, stop time 0 to 60 seconds |
| | Regenerated braking torque | | Approximately 20 % (up to 125 % possible with optional braking resistor or externally mounted chopper unit, 2.2 to 11 kW models have brake chopper built-in) |
| | V/f pattern | | Adjustable V/f pattern |
| Operating characteristics | Frequency setting | Keypad | Setting by ▲ ▼ |
| | | External signal | Potentiometer 5 kΩ / 0.5 W, 0 to +10V _{DC} , 4 to 20 mA, RS-485 interface; Multi-function inputs 3 to 9 (15 steps, jog, up/down) |
| | Operation setting signal | Keypad | Set by RUN and STOP |
| | | External signal | 2 wires/3 wires (MI1, MI2, MI3), JOG operation, RS-485 serial interface (MODBUS), programmable logic controller |
| | Multi-function input signal | | Multi-step selection 0 to 15, JOG, accel/decel inhibit, 2 accel/decel switches, counter, external base block, auxiliary motor control is invalid, ACI/AVI selections, driver reset, UP/DOWN key settings, NPN/PNP input selection |
| | Multi-function output indication | | Device operating, frequency attained, zero speed, base block, fault indication, overheat alarm, emergency stop and status selections of input terminals |
| | Analog output signal | | Output frequency/current |
| Alarm output contact | | | Contact will be on when drive malfunctions (1 form c/change-over contact and 1 open collector output for standard type) |

| | |
|----------------------|---|
| Operation functions | Built-in PLC, AVR, accel/decel S-curve, over-voltage/over-current stall prevention, 5 fault records, reverse inhibition, momentary power loss restart, DC braking, auto torque/slip compensation, auto tuning, adjustable carrier frequency, output frequency limits, parameter lock/reset, vector control, PID control, external counter, MODBUS communication, abnormal reset, abnormal re-start, power-saving, fan control, sleep/wake frequency, 1st/2nd frequency source selections, 1st/2nd frequency source combination, NPN/PNP selection |
| Protection functions | Over voltage, over current, under voltage, external fault, overload, ground fault, overheating, electronic thermal, IGBT short circuit, PTC |
| Display keypad | 6-key, 7-segment LED with 4-digits, 5 status LEDs, master frequency, output frequency, output current, custom units, parameter values for setup and lock, faults, RUN, STOP, RESET, FWD/REV, PLC |
| Approvals | <p>POWER CONVERSION EQUIPMENT</p>  <p>LISTED 38WA</p> |

D.5 Fuse protection

We differ between the protection of the supply cables and the protection of the device. In order to fulfill the CE specifications - here especially EN60204-1 - you have to protect the supply cables.

Protect the device in UL-certified installations with suitable semiconductor- or total range fuses.

NOTE



In UL-certificated installations you must place the UL-listed fuses or „Circuit breaker“.

Cable protection

Place in safety fuses of the operation class gL DIN VDE 0636-201 / IEC 60269-2-1 / HD 630.2.1 54 or cable protection switches with the triggering characteristic K referring to DIN VDE 0636-201 / IEC 60204-1 60269-2-1 / HD 630.2.1 54, to protect the cables. These fuses protect against overloading and from consequential damages from faults e. g. by fire. You cannot prevent, that the device is extensively destroyed, if a short circuit or an ground fault occurs in the DC link.

Execute the protection according to EN 60204-1 ('Electrical equipment of machines'). Dimension the cable protection fuses, dependent on the used cross section according to the, at the time, valid, national standards and local regulations.

Device protection

Place in semiconductor fuses with the triggering characteristic aR DIN VDE 0636-201 / IEC 60269-2-1 HD 630.2.1 54. Switch these in series to the cable protection fuses. These protect the input-sided rectifier-triggering, in case of a short circuit, against completely destruction, so that a repair of the device is possible.

Dimension the suitable device protection fuses, dependent on the peak current and the required limit load integral i^2t_{OFF} .

See [ZB.4 Fuses for device-protection](#)— on page 132.

Cable protection + device protection

You have two possibilities to protect the cable and the device:

m connect fuses and semiconductors in series

m use whole range fuses with trigger characteristic gR (DIN VDE 0636-201/IEC 60269-2-1/HD 630.2.154)

Dimension the suitable cable and device protection fuses dependent on the used cross section of the used mains line, from the peak current and the demanded limit load integral i^2t_{OFF} .

Deviant to the fuses these devices and supply systems also may also assure be UL-listed „Circuit breaker“ (DIVQ).

Permitted are only „Circuit breaker“ without tripping delay. Circuit breakers with a thermal tripping characteristic are not checked and therewith not approved. In case of an error it must be considered, that the device is not protected against destruction, but only is protected against fire danger.

Dimension the suitable „Circuit breaker“ dependent of the cross section of the inserted supply system, as well as from the nominal- and peak current of the converter.

D.5.1 Cable protection

The current-carrying capacity of conductors is determined in table 5 of EN60204-1. For your operation you must determine the accordant value in the standard yourself, by taking into consideration, amongst other things the cable mounting. Here you will find an extraction for the laying of PVC- isolated cables on open cable racks:

| Cable cross section | Fuse rated current |
|---------------------|--------------------|
| 1.5 mm ² | 16.1 A |
| 2.5 mm ² | 22 A |
| 4 mm ² | 30 A |

Use suitable fuses with the enable characteristic gL or gR.

D.5.2 Cable protection + device protection

Consider by your choice of the whole range fuses the current-carrying capacity connected mains cables and the allowable maximum load of the device.

Recommended UL-listed fuses, see [ZB.4 Fuses for device-protection](#)— on page 132.

D.6 Type of protection

| | |
|--------------------|-------|
| Type of protection | IP 20 |
|--------------------|-------|

D.7 Fire fighting appliances

| | |
|-----------------|------------|
| Fight fire with | ABC powder |
|-----------------|------------|



APPENDIX E - CANopen

In this chapter you find the detailed information according to **b maXX® BM1000** CANopen interface.

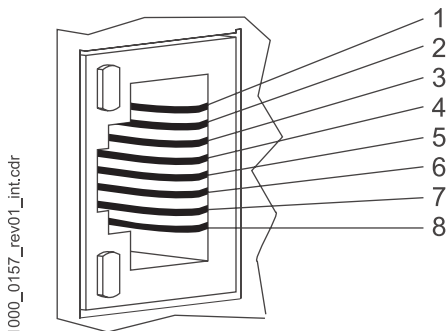
E.1 Interface assignment

The interface is used to realize the communication within a CANopen ring or to communicate with the **b maXX® BM1000** via Modbus.

In addition the interface can be used as a power supply for external devices, e.g. communication modules.

Pin assignment

Female connector 8-pin



| Pin no. | CANopen | Modbus (RS485) |
|---------|----------|----------------|
| 1 | CAN high | |
| 2 | CAN low | |
| 3 | CAN GND | |
| 4 | | SG - |
| 5 | | SG + |
| 6 | reserved | reserved |
| 7 | CAN GND | |
| 8 | reserved | reserved |

E.2 Terminating plug for CANopen

The **b maXX® BM1000** must be equipped with a termination plug BM4-CAN-T01 (according CIA Standard 120 Ω , 0.25 W) if the device is the last participant within the CANopen network, see [ZAccessories CANopen](#)— on page 136.

E.3 Connection cables

For available connection cables refer to [ZAccessories CANopen](#)— on page 136.

E.4 Input wiring before using CANopen

E.g. **P1093** = 23.

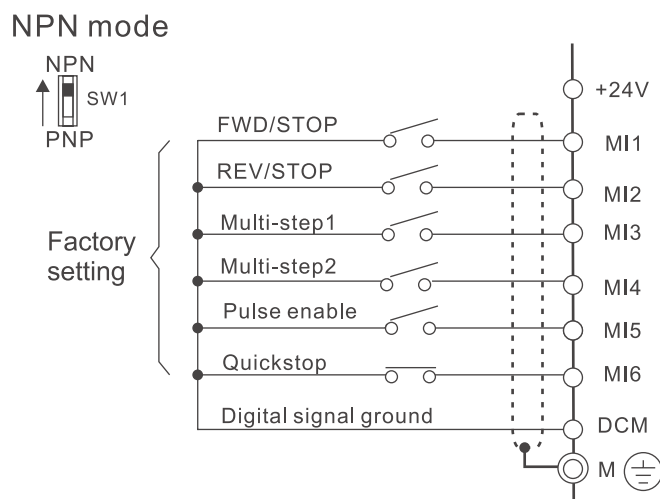


Figure 76: Input wiring

E.5 Setting of address and baudrate

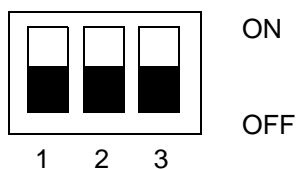
E.5.1 Setting via software parameters **P0870** and **P0871**

The address and baudrate is set in parameters **P0870** and **P0871** directly. The DIP switches are deactivated.

□ DIP switch setting

The DIP switches 1, 2, 3 must be set to OFF to enable the setting of the CANopen address via parameters **P0870** and the baudrate via parameter **P0871**.

2^0 2^1 2^2



☐ CANopen address setting via parameter **P0870**

The settable address range is 1 to 127.

Parameter **P0870** = 0 deactivates the software setting!

Address 1 ⇒ **P0870** = 1

.....

Address 127 ⇒ **P0870** = 127

Default value: **P0870** = 1

☐ CANopen baudrate setting via parameter **P0871**

Default value: **P0871** = 1

| P0871 | Baudrate kbit/s |
|--------------|--------------------|
| 0 | 1000 |
| 1 | 500 |
| 2 | 250 |
| 3 | 125 |
| 4 | 100 |
| 5 | 50 |

E.5.2 Setting of address via DIP switch without multiplier

P2148 = 0, address setting via DIP switch without multiplier.

The DIP switch setting defines from which parameter **P2141** to **P2147** the CANopen address is read and copied to **P0870**.

The baudrate must be set via **P2140** if the DIP switch is set $\neq 0$.

The value set in **P2140** is copied internal to **P0871** and used as baudrate.

☐ DIP switch setting

The DIP switch must be set $\neq 0$. The setting range is 1 to 7.

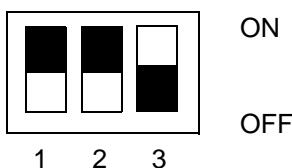
☐ CANopen address settings via address storage.

The multiplier parameter **P2148** must be set to 0. This setting deactivates the multiplier.

| DIP switch setting | Address storage parameter | Default values |
|--------------------|---------------------------|----------------|
| 1 | P2141 | 21 |
| 2 | P2142 | 22 |
| 3 | P2143 | 23 |
| 4 | P2144 | 24 |
| 5 | P2145 | 25 |
| 6 | P2146 | 26 |
| 7 | P2147 | 27 |

Example:

2^0 2^1 2^2



DIP switch value = 3 is set, the address is read from **P2143**. The stored address value in **P2143** (23 default value) is copied to **P0870** and used as CANopen address.

The value range of parameters **P2141** to **P2147** is 0 to 127, the address range can be set from 1 to 127.

☐ CANopen baudrate setting via **P2140**

Default value: **P2140** = 2

| P2140 | Baudrate kbit/s |
|--------------|-----------------|
| 0 | 1000 |
| 1 | 500 |
| 2 | 250 |
| 3 | 125 |
| 4 | 100 |
| 5 | 50 |

E.5.3 Setting of address via DIP switch with multiplier

P2148 \neq 0, address setting via DIP switch with multiplier.

The DIP switch values 1 to 7 select **P2141** to **P2147**. The CANopen address is **P2148** multiplied with the selected parameter (**P2141** to **P2147**) and then copied to **P0870** automatically.

The baudrate must be set via **P2140** if the DIP switch is set \neq 0.

The value set in **P2140** is copied internal to **P0871** and used as baudrate.

☐ DIP switch setting

The DIP switch must be set \neq 0. The setting range is 1 to 7.

The DIP switch values 1 to 7 select **P2141** to **P2147**. The CANopen address is **P2148** multiplied with the selected parameter (**P2141** to **P2147**) and then copied to **P0870** automatically.

☐ CANopen address settings via DIP switch and multiplier

The multiplier parameter **P2148** must be set \neq 0.

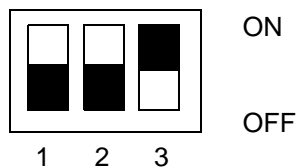
Default value: **P2148** = 8

The CANopen address is calculated as follows:

$$\text{CANopen address} = \text{DIP switch} \cdot \mathbf{P2148}$$

Example:

$$2^0 \quad 2^1 \quad 2^2$$



| DIP switch setting | Address storage parameter |
|--------------------|---------------------------|
| 1 | P2141 |
| 2 | P2142 |
| 3 | P2143 |
| 4 | P2144 |
| 5 | P2145 |
| 6 | P2146 |
| 7 | P2147 |

For example the DIP switch setting is 4 and the multiplier **P2148** = 4

⇒ CANopen address = 16

Because of the DIP switch setting = 4, the calculated address value (= 16) is stored in address storage parameter **P2144**, copied to **P0870** and used as CANopen address.

□ CANopen baudrate setting via **P2140**

Default value: **P2140** = 2

| P2140 | Baudrate kbit/s |
|--------------|--------------------|
| 0 | 1000 |
| 1 | 500 |
| 2 | 250 |
| 3 | 125 |
| 4 | 100 |
| 5 | 50 |

E.6 CANopen display functions

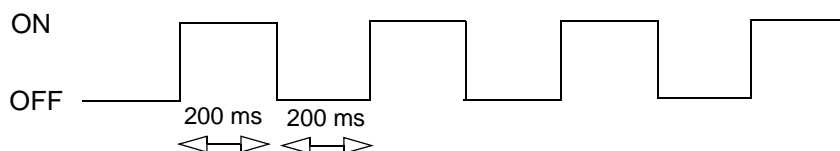
E.6.1 LED display

LED H3 displays the status of the CANopen interface.

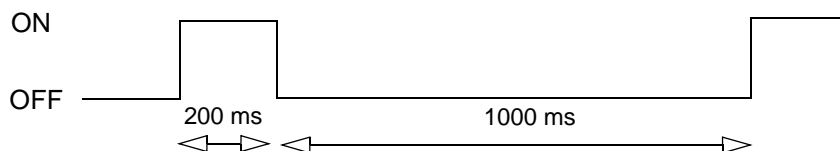
H3 fulfills the specification according „DR-303-3 indicator specification“.

m CANopen initialization display via LED H3 (orange)

n Start of initialization: H3 is blinking in orange color



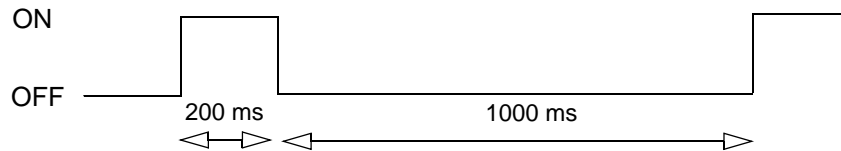
n End of initialization: H3 is blinking in orange color



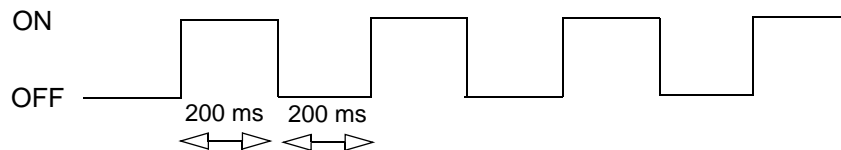
n Initialization completed H3 is off

m CANopen status display via LED H3 (green)

n State **STOPPED**: H3 is blinking in green color



n State **PREOPERATIONAL**: H3 is blinking in green color



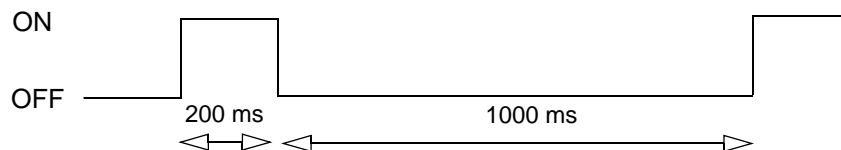
n State **OPERATIONAL**: H3 is ON in green color

n State **RESET**: H3 is OFF during RESET

m CANopen error display via LED H3 (red)

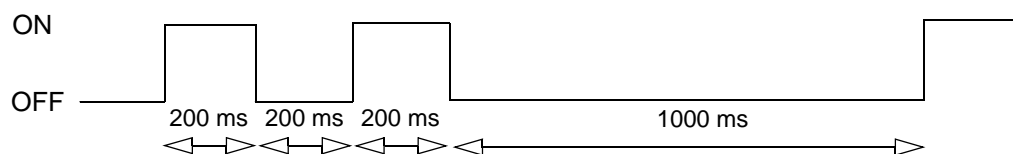
n At least one of the error counters has reached warning level

m H3 is blinking in red color



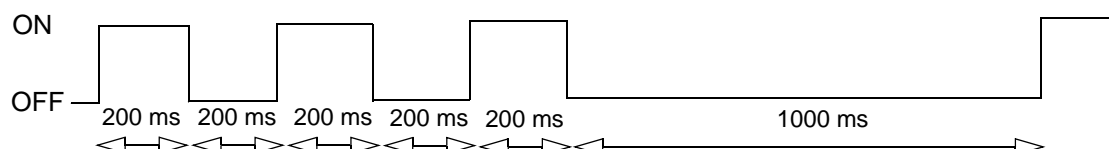
n „Guard“ (NMT master or NMT slave) or „Heartbeat“ event

m H3 is blinking in red color



n Sync message hasn't been received within the configured communication cycle

m H3 is blinking in red color



n No communication between CAN interface and CANopen master

m H3 is ON in red color

E.6.2 CANopen error display via digital keypad

| | |
|------|--|
| cc01 | At least one of the error counters has reached warning level |
| cc02 | „Guard“ (NMT master or NMT slave) or „Heartbeat“ event |
| cc03 | Sync message hasn't received within the configured communication cycle |
| cc04 | No communication between CAN interface and CANopen master |
| cc05 | Hardware failure or no CANopen hardware available on processing unit |
| cc06 | No CANopen software available on processing unit |
| cc07 | An update of CANopen is necessary |
| cc08 | Hardware error |



APPENDIX F - HOW TO SELECT THE RIGHT B MAXX®

The choice of the right **b maXX®** drive for the application is very important and has great influence on its lifetime. If the capacity of **b maXX®** drive is too large, it cannot offer complete protection to the motor and the motor maybe damaged. If the capacity of **b maXX®** drive is too small, it cannot offer the required performance and the **b maXX®** drive maybe damaged due to overloading.

But by simply selecting the **b maXX®** drive of the same capacity as the motor, user application requirements cannot be met completely. Therefore, a designer should consider all the conditions, including load type, load speed, load characteristic, operation method, rated output, rated speed, power and the change of load capacity. The following table lists the factors you need to consider, depending on your requirements.

| Item | | Related specification | | | |
|---|--|----------------------------------|--------------|-------------------|-----------------|
| | | Speed and torque characteristics | Time ratings | Overload capacity | Starting torque |
| Load type | Friction load and weight load Liquid (viscous) load Inertia load Load with power transmission | m | | | m |
| Load speed and torque characteristics | Constant torque Constant output Decreasing torque Decreasing output | m | m | | |
| Load characteristics | Constant load Shock load Repetitive load High starting torque Low starting torque | m | m | m | m |
| Continuous operation, short-time operation Long-time operation at medium/low speeds | | | m | m | |
| Maximum output current (instantaneous) Constant output current (continuous) | | m | | m | |
| Maximum frequency, Base frequency | | m | | | |
| Power supply transformer capacity or percentage impedance Voltage fluctuations and unbalance Number of phases, single phase protection Frequency | | | | m | m |
| Mechanical friction, losses in wiring | | | | m | m |
| Duty cycle modification | | | m | | |

F.1 Capacity formulas

1 When one **b maXX®** drive operates one motor

The starting capacity should be less than 1.5 x rated capacity of **b maXX®** drive

The starting capacity =

$$\frac{k \cdot N}{973 \cdot \eta \cdot \cos \varphi} \left[T_L + \frac{GD^2}{375} \cdot \frac{N}{t_A} \right] \leq 1,5 \cdot \text{capacity of the b maXX® drive [kVA]}$$

2 When one **b maXX®** drive operates more than one motor

m The starting capacity should be less than the rated capacity of **b maXX®** drive

n Acceleration time ≤ 60 seconds

The starting capacity

$$= \frac{k \cdot N}{\eta \cdot \cos \varphi} [n_r + n_s(k_s - 1)] = P_{C1} \left[1 + \frac{n_s}{n_r}(k_s - 1) \right] \leq 1,5 \cdot \text{capacity of the b maXX® drive [kVA]}$$

n Acceleration time ≥ 60 seconds

The starting capacity

$$= \frac{k \cdot N}{\eta \cdot \cos \varphi} [n_r + n_s(k_s - 1)] = P_{C1} \left[1 + \frac{n_s}{n_r}(k_s - 1) \right] \leq \text{capacity of the b maXX® drive [kVA]}$$

m The current should be less than the rated current of **b maXX®** drive (A)

n Acceleration time ≤ 60 seconds

$$n_r + I_M \left[1 + \frac{n_s}{n_r}(k_s - 1) \right] \leq 1,5 \cdot \text{rated current of b maXX® drive [A]}$$

n Acceleration time ≥ 60 seconds

$$n_r + I_M \left[1 + \frac{n_s}{n_r}(k_s - 1) \right] \leq \text{rated current of b maXX® drive [A]}$$

m When it is running continuously

n The requirement of load capacity should be less than the capacity of **b maXX®** drive (kVA)

The requirement of load capacity =

$$\frac{k \cdot P_M}{\eta \cdot \cos \varphi} \leq \text{capacity of the b maXX® drive [kVA]}$$

n The motor capacity should be less than the capacity of **b maXX®** drive (kVA)

$$k \cdot \sqrt{3} \cdot V_M \cdot I_M \cdot 10^{-3} \leq \text{capacity of the b maXX® drive [kVA]}$$

n The current should be less than the rated current of **b maXX®** drive (A)

$$k \cdot I_M \leq \text{the rated current of the b maXX® drive [A]}$$

Symbol explanation

P_M Motor shaft output for load (kW)

η Motor efficiency (normally, approx. 0.85)

$\cos \varphi$ Motor power factor (normally, approx. 0.75)

V_M Motor rated voltage (V)

I_M Motor rated current (A), for commercial power

k Correction factor calculated from current distortion factor (1.05-1.1, depending on PWM method)

P_{C1} Continuous motor capacity (kVA)

k_s Starting current/rated current of motor

n_r Number of motors in parallel

n_s Number of simultaneously started motors

GD^2 Total inertia (GD^2) calculated back to motor shaft (kg m²)

T_L Load torque

t_A Motor acceleration time

N Motor speed

F.2 General precaution

Selection note

- 1 When the **b maXX®** drive is connected directly to a large-capacity power transformer (600 kVA or above) or when a phase lead capacitor is switched, excess peak currents may occur in the power input circuit and the converter section may be damaged. To avoid this, use an input reactor (optional) before **b maXX®** drive mains input to reduce the current and improve the input power efficiency.
- 2 When a special motor is used or more than one motor is driven in parallel with a single **b maXX®** drive, select the **b maXX®** drive current $1.25 \times$ (sum of the motor rated currents).
- 3 The starting and accel./decel. characteristics of a motor are limited by the rated current and the overload protection of the **b maXX®** drive. Compared to running the motor D.O.L. (Direct On-Line), a lower starting torque output with **b maXX®** drive can be expected. If higher starting torque is required (such as for elevators, mixers, tooling machines, etc.) use an **b maXX®** drive of higher capacity or increase the capacities for both the motor and the **b maXX®** drive.
- 4 When an error occurs on the drive, a protective circuit will be activated and the **b maXX®** drive output is turned off. Then the motor will coast to stop. For an emergency stop, an external mechanical brake is needed to quickly stop the motor.

Parameter settings note

- 1 The **b maXX®** drive can be driven at an output frequency up to 400 Hz (less for some models) with the digital keypad. Setting errors may create a dangerous situation. For safety, the use of the upper limit frequency function is strongly recommended.
- 2 High DC braking operating voltages and long operation time (at low frequencies) may cause overheating of the motor. In that case, forced external motor cooling is recommended.
- 3 Motor accel./decel. time is determined by motor rated torque, load torque, and load inertia.
- 4 If the stall prevention function is activated, the accel./decel. time is automatically extended to a length that the **b maXX®** drive can handle. If the motor needs to decelerate within a certain time with high load inertia that can't be handled by the **b maXX®** drive in the required time, either use an external braking resistor and/or brake unit, depending on the model, (to shorten deceleration time only) or increase the capacity for both the motor and the **b maXX®** drive.

F.3 How to choose a suitable motor

F.3.1 Standard motor

When using the **b maXX**[®] drive to operate a standard 3-phase induction motor, take the following precautions:

- 1 The energy loss is greater than for an inverter duty motor.
- 2 Avoid running motor at low speed for a long time. Under this condition, the motor temperature may rise above the motor rating due to limited airflow produced by the motor's fan. Consider external forced motor cooling.
- 3 When the standard motor operates at low speed for long time, the output load must be decreased.
- 4 The load tolerance of a standard motor is as follows:

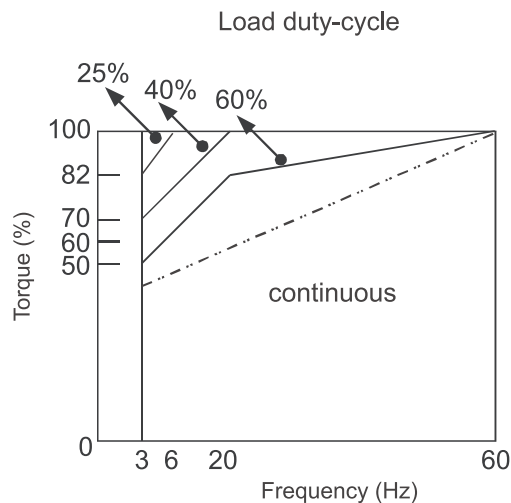


Figure 77: Load duty-cycle

- 5 If 100 % continuous torque is required at low speed, it may be necessary to use a special inverter duty motor.
- 6 Motor dynamic balance and rotor endurance should be considered once the operating speed exceeds the rated speed (60 Hz) of a standard motor.
- 7 Motor torque characteristics vary when an **b maXX**[®] drive instead of commercial power supply drives the motor. Check the load torque characteristics of the machine to be connected.
- 8 Because of the high carrier frequency PWM control of the **b maXX**[®] series, pay attention to the following motor vibration problems:
 - m Resonant mechanical vibration: anti-vibration (damping) rubbers should be used to mount equipment that runs at varying speed.
 - m Motor imbalance: special care is required for operation at 50 or 60 Hz and higher frequency.
 - m To avoid resonances, use the skip frequencies.
- 9 The motor fan will be very noisy when the motor speed exceeds 50 or 60Hz.

F.3.2 Special motors:

- 1 Pole-changing (Dahlander) motor:
The rated current differs from that of a standard motor. Please check before operation and select the capacity of the **b maXX®** drive carefully. When changing the pole number the motor needs to be stopped first. If over current occurs during operation or regenerative voltage is too high, please let the motor free run to stop (coast).
- 2 Submersible motor:
The rated current is higher than that of a standard motor. Please check before operation and choose the capacity of the **b maXX®** drive carefully. With long motor cable between **b maXX®** drive and motor, available motor torque is reduced.
- 3 Explosion-proof (Ex) motor:
The **b maXX®** needs to be installed in a safe place and the wiring should comply with the (Ex) requirements. **b maXX®** motor drives are not suitable for (Ex) areas with special precautions.
- 4 Gear reduction motor:
The lubricating method of reduction gearbox and speed range for continuous operation will be different and depending on brand. The lubricating function for operating long time at low speed and for high-speed operation needs to be considered carefully.
- 5 Synchronous motor:
The rated current and starting current are higher than for standard motors. Please check before operation and choose the capacity of the **b maXX®** drive carefully. When the **b maXX®** drive operates more than one motor, please pay attention to starting and changing the motor.

F.4 Power Transmission Mechanism

Pay attention to reduced lubrication when operating gear reduction motors, gearboxes, belts and chains, etc. over longer periods at low speeds. At high speeds of 50/60 Hz and above, life-time reducing noises and vibrations may occur.

F.5 Motor torque

The torque characteristics of a motor operated by a **b maXX**[®] drive and commercial mains power are different.

Below you'll find the torque-speed characteristics of a standard motor (4-pole, 15 kW):

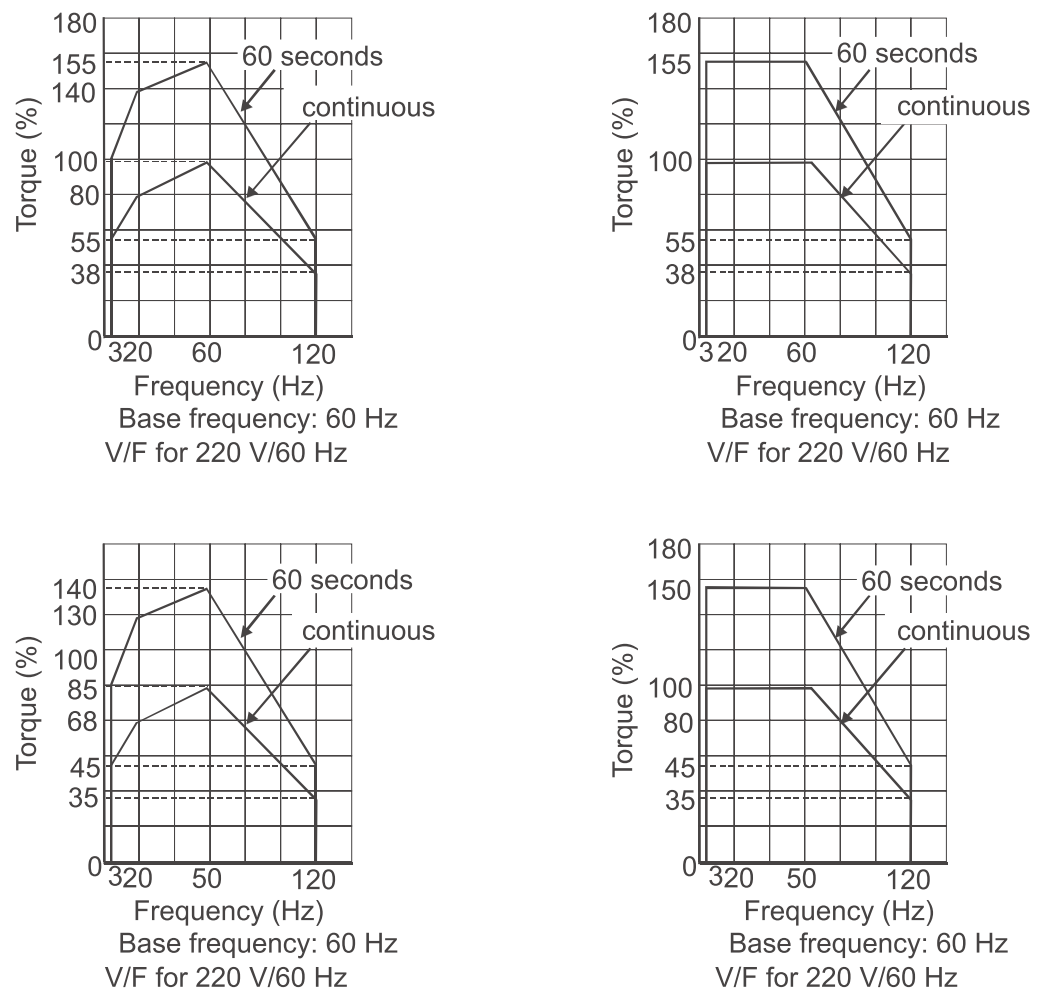


Figure 78: Motor torque



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Revision survey

| Version | Date | Changing |
|------------|------------|---------------|
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Notes:

be in motion

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